# जीव विज्ञान

कक्षा XI-XII की पाठ्यपुस्तक

## सम्पादक मंडल



## पुनरीक्षक



## लेखक


डा० वी० सी० शाह
अध्यक्ष, प्राणिविज्ञान विभाग
गुजरात विश्वविद्यालय
अहमदाबाद

डा० आइ० ए० नियाजी
प्राणिविज्ञान विभाग
राजस्थान विश्वविद्यालय
जयपुर

डा० जे० एस० गिल
विज्ञान एवं गणित शिक्षा विभाग
राष्ट्रीय शिक्षा संस्थान
नई दिल्ली

डा० यू० के० सिनहा
वनस्पतिशास्त्र विभाग
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डा० अरुणकुमार मिश्र
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प्रो० एच० वाई० मोहनराम
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प्रो० (श्रीमती) जी० घोष
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डा० राजेश्वर राव
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श्री प्रेमानंद चंदोला (अनुवादक)
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नई दिल्ली

# जीव विज्ञान

## कक्षा XI-XII की पाठ्यपुस्तक

### भाग 2

(द्वितीय खंड)

[ अनुभाग 2 ]

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्

# प्रस्तावना

यह पुस्तक, कक्षा XI की जीवविज्ञान की पाठ्यपुस्तक का अगला क्रम है। यह पुस्तक जीवविज्ञान के महत्त्वपूर्ण क्षेत्रों, जैसे कोशिका-जीवविज्ञान, आनुवंशिकी, परिवर्धन जीवविज्ञान तथा मानव कल्याण के लिए जीवविज्ञान का व्यवहार से संबंधित संकल्पनाओं का विवरण देती है। ये समस्त संकल्पनाएँ, विद्यार्थियों के पूर्व ज्ञान के आधार पर विकसित की गई हैं। इसके लेखक जीवविज्ञान के इन क्षेत्रों के विशेषज्ञ हैं। उन्होंने इस बात का पूर्ण प्रयास किया है कि छात्रों को इन विषयों से संबंधित अधुनातन ज्ञान दिया जा सके जिससे उनमें उच्च स्तर की शिक्षा प्राप्त करने की इच्छा जागृत हो।

इस कार्य को अत्यल्प समय में पूरा करने के लिए मैं लेखकों तथा पुनरीक्षकों को धन्यवाद देता हूँ। प्रकाशन की जल्दी के कारण, इस पुस्तक का लेखन, पुनरीक्षण तथा संपादन बहुत ही शीघ्रता में किया गया है। इस कारण, पुस्तक में कुछ त्रुटियाँ रह जाने की आशंका है। ऐसी त्रुटियों को दूर करने के लिए अथवा पुस्तक को अधिक से अधिक उत्तम बनाने के लिए आपके विचारों का हम कृतज्ञतापूर्वक स्वागत करेंगे।

शिवकुमार मित्र
निदेशक
राष्ट्रीय शैक्षिक अनुसंधान और
प्रशिक्षण परिषद्

नई दिल्ली
सितम्बर 1978

# आमुख

आज के युग में जीवविज्ञान का विकास अद्भुत गति से हुआ है और मानव-ज्ञान की सभी प्रमुख शाखाओं पर इसका प्रभाव पड़ा है। आशा है, जीवविज्ञान के अध्ययन से भोजन, स्वास्थ्य और आवास आदि की सभी प्रमुख समस्याओं का समाधान हो सकेगा। जीवविज्ञान के गहन अध्ययन के लिए विद्यार्थी को विभिन्न पेड़-पौधों, जीव-जन्तुओं तथा मानव की संरचना और क्रियात्मक संघटना की सही-सही जानकारी प्राप्त करनी होगी। इस विषय की प्रगति के इतिहास और उसके आधुनिक स्वरूप की जानकारी प्राप्त करते समय विद्यार्थी को यह भी सीखना होगा कि उसके दैनिक जीवन में जीवविज्ञान का क्या महत्त्व है और उसे किस प्रकार व्यवहार में लाया जा सकता है। इसके अध्ययन से उसके लिए उच्च शिक्षा एवं विभिन्न व्यवसायों का द्वार तो खुलेगा ही, साथ ही अपने परिवेश की जीव-सृष्टि, उसके प्रक्रमों तथा घटनाक्रम की जानकारी के आधार पर वह जीवन में प्रवेश करते हुए अधिक संतोष अनुभव कर सकेगा।

12 वीं कक्षा की प्रस्तुत पुस्तक उक्त आवश्यकता की ही पूर्ति की दिशा में तैयार की गई है। मैं संपादक-मंडल के सभी सदस्यों, लेखकों, पुनरीक्षकों का आभारी हूँ जिन्होंने इतने थोड़े समय में ही इस कार्य को पूरा किया है। चूंकि इस पुस्तक का लेखन, संशोधन और संपादन बहुत जल्दी में किया गया है ताकि इसका प्रकाशन निर्धारित अवधि के भीतर ही पूरा हो सके, अत: इसमें कुछ कमियाँ रह जाना स्वाभाविक ही है। इन कमियों को आगामी संस्करण में सुधार लिया जाएगा। हम पुस्तक के पाठक-वर्ग के विचारों और सुझावों का हार्दिक स्वागत करते हैं।

**प्राणिविज्ञान विभाग**
**दिल्ली विश्वविद्यालय**
**दिल्ली**

**एम० आर० एन० प्रसाद**
**अध्यक्ष**
**जीवविज्ञान सम्पादक मंडल**

# विषय-सूची



## इकाई 2

### परिवर्धन जीव विज्ञान (प्राणि विज्ञान)

[शेषांश]



## इकाई 3

### जीव विज्ञान और मानव कल्याण

# अध्याय-21

# भ्रूणीय परिवर्धन के समय की अपसामान्यताएँ

भ्रूणीय परिवर्धन की सारी अवधि खतरों से भरी है। कई कारक है जो परिवर्धन की सामान्य प्रक्रिया को बाधा पहुँचाते व तोड़ते-मरोड़ते हैं। इन गड़बड़ियों से दो प्रकार के परिणाम सामने आ सकते हैं : (i) भ्रूण भ्रूणोद्भव की किसी अवस्था में नष्ट हो सकता है, या (ii) संरचना में और/अथवा कार्य में दोषपूर्ण अपसामान्य संतान का स्फुटन या जन्म हो सकता है। जीवविज्ञान का वह क्षेत्र, जो भ्रूणोद्भव के दौरान अपसामान्य परिवर्धन से सम्बन्ध रखता है **विरूपताविज्ञान** (टिरेटोलॉजी) कहलाता है।

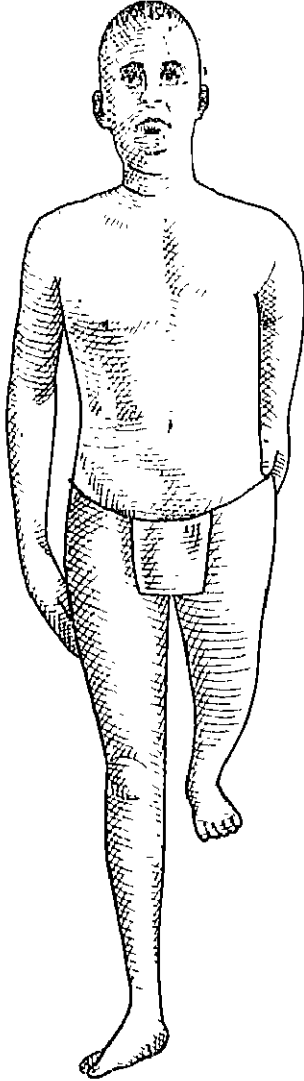
परिवर्धन के दौरान ये अपसामान्यताएँ कई भिन्न-भिन्न कारणों से हो सकती हैं। अब तक की जानकारी के अनुसार ये अपसामान्यताएँ आनुवंशिक (जेनेटिक) कारणों, हानिप्रद बाहरी कारकों अथवा कुपोषण (मालन्यूट्रिशन) के परिणामस्वरूप हो सकती हैं।

## (I) आनुवंशिक कारणों से होने वाली अपसामान्यताएँ

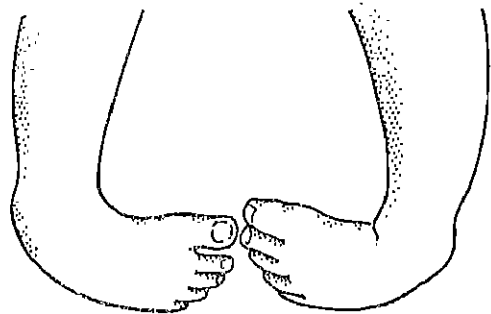
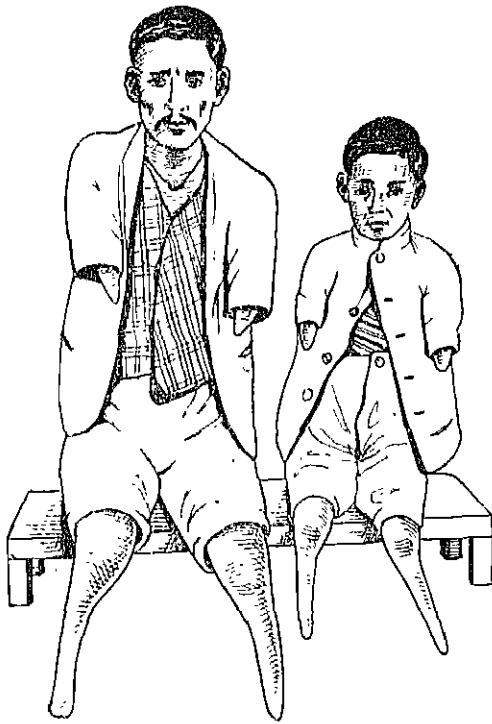
इनमें वे दोष शामिल हैं जो गुणसूत्रों की सामान्य संख्या कम या अधिक होने (**गुणसूत्री दोष**) या **जीनउत्परिवर्तन** (**जीनम्यूटेशन**) के कारण होते हैं। इन कारकों से उत्पन्न होने वाली अधिकांश अपसामान्यताएँ इतनी उग्र होती हैं कि भ्रूण अपना परिवर्धन पूरा करने के पहले ही या तुरन्त बाद मर जाता है। लेकिन कुछ पैदा हो जाते हैं और काफ़ी लम्बे समय तक जिन्दा रहते हैं। यदि ये अपसामान्यताएँ भ्रूण के केवल किसी भाग की कायिक कोशिकाओं में होती हैं तो वे वर्धमान प्राणी के केवल कुछ भाग को ही प्रभावित करती हैं। ऐसी दशा में यह दोष वंशागत नहीं होता और व्यक्ति की मृत्यु के साथ ही गायब हो जाता है।

गुणसूत्री दोष (क्रोमोसोमल एरर) से होने वाली एक जानी पहचानी गड़बड़ी **मंगोलिज्म** है, जिसे **मंगोलकल्प जड़बुद्धिता** (मंगोलॉइड ईडियोसी) भी कहते हैं। इस प्रकार से उत्पन्न व्यक्ति शारीरिक और कार्यशीलता की दृष्टि से जन्मजात जड़बुद्धि (ईडियट) होते हैं (चित्र 21.1)।

चित्र 21.1 : मंगोलिज्म (जन्मजात जड़बुद्धिता)—यानी जनन-कोशिकाओं में गुणसूत्री दोष के कारण परिवर्धन सम्बंधी आनुवंशिक अपसामान्यता वाले लड़कों का समूह।

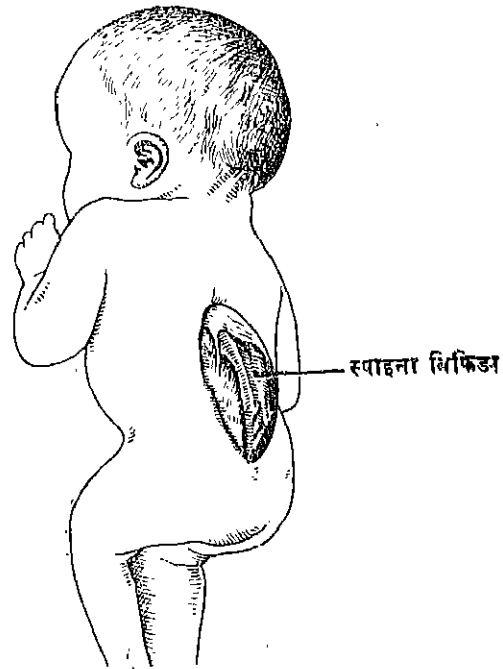
700 पैदा होने वालों में से लगभग 1 मंगोल होता है और ऐसे उत्पन्न जड़बुद्धि व्यक्तियों की संख्या माता की उम्र के साथ-साथ बढ़ती जाती है।

चित्र 21.2 : उपास्थिअविकसन (एकॉन्ड्रोप्लासिया)—यानी परिवर्धन सम्बन्धी आनुवंशिक अपसामान्यता का रोगी। शरीर का दाहिना आधा भाग सामान्य है और बाँया आधा भाग बौने का।

संरचना या कार्यशीलता की दृष्टि से होने वाले अनेक दोष **जनन-कोशिकाओं में जीनउत्परिवर्तनों** के कारण होते हैं। यूँ तो उत्परिवर्तन प्राकृतिक रूप से होते हैं लेकिन कृत्रिम रूप से ये एक्स-किरणों (एक्स-रे) द्वारा या उत्परिवर्तजन (म्यूटाजेन) नामक रासायनिक पदार्थों से भी उत्पन्न किए जा सकते है।

मानव में जाने-पहचाने आनुवंशिक दोष ये हैं—**वर्णांधता (कलर ब्लॉइन्डनेस), फटे ओंठ (हेयर लिप), खंड तालु (क्लेफ्ट पैलेट), पाँव फिरा होना (क्लब फूट), हृदय में छिद्र, हाथों, पाँवों, बाहुओं अथवा टाँगों की अनुपस्थिति** आदि (चित्र 21.2, 21.3, 21.4)। जीन-उत्परिवर्तनों के कारण होने वाले कुछ दोष **उपापचय के अंतर्जात दोष** (इनबॉर्न एरर्स ऑफ मेटाबोलिजम) कहलाते हैं। उपापचय के अंतर्जात दोष का एक उदाहरण **फेनिलकीटोनमेह (फेनिलकीटोन्यूरिया)** है। इस दशा में भ्रूण प्रोटीनमय भोजन का उचित रूप से उपयोग नहीं कर पाता और **फेनिलएलानीन** नामक एक अमीनो अम्ल और उसके कुछ व्युत्पन्न (डेरिवेटिव) शरीर के लिए अधिक आविषालु (टॉक्सिक) स्तर तक जमा हो जाते हैं। इसका परिणाम यह होता है कि वृद्धि और मस्तिष्क का परिवर्धन उग्र और स्थायी रूप से मंद पड़ जाता है। लेकिन इस गड़बड़ी का पता आरम्भिक अवस्था में लगाया जा सकता है और नियमित आहार से व्यक्ति सामान्य जिन्दगी जी सकता है। उपापचय की ये अंतर्जात

चित्र 21.3 : **पाँव फिरा होना (क्लब फूट)**; जो परिवर्धन सम्बन्धी आनुवंशिक अपसामान्यता है।

चित्र 21.4 : **मीरोमीलिया या खूंटी-जैसे** पाद, बिना हाथ-पैरों के परिवर्धन की एक आनुवंशिक अपसामान्यता। चित्र में पिता और पुत्र को दिखाया गया है। माता सामान्य थी।

गड़बड़ियाँ कई और भी हो सकती हैं लेकिन आरम्भिक अवस्था में ही उनकी पहचान और तदनुसार उपचार की विधियों को अभी खोजा जाना बाकी है।

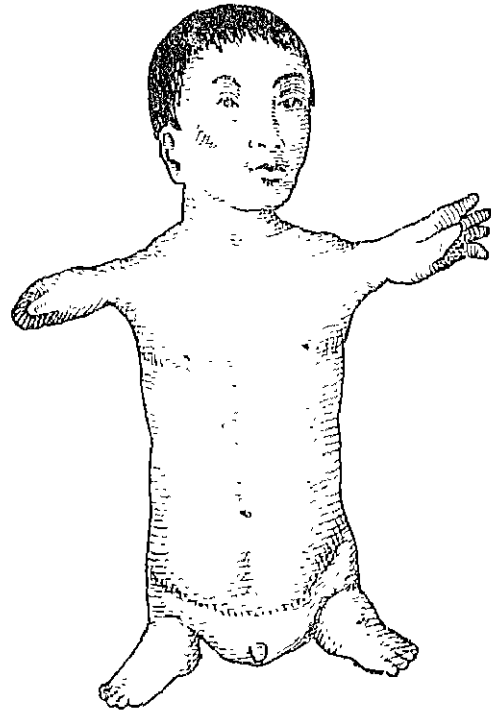
## (2) बाहरी हानिप्रद कारकों से उत्पन्न अपसामान्यताएँ

भ्रूण या गर्भ पर कई रोगकारी जीव, रासायनिक पदार्थ, दवाएँ, एक्स-किरणें व अन्य विकिरण तथा प्रतिरक्षी (एन्टीबॉडीज) हानिकारक प्रभाव उत्पन्न करते है लेकिन ये माता को उतनी अधिक हानि नहीं पहुँचाते। उदाहरण के लिए यदि गर्भवती माता पर जर्मन मीजल्स (रुबेला) का आक्रमण होता है, विशेषकर गर्भावस्था के तीसरे से लेकर बारहवें हफ्ते के दौरान तो इस रोग का वाइरस (विषाणु) गर्भ को भारी नुकसान पहुँचाता है। शिशु में कई गड़बड़ियाँ उत्पन्न हो सकती हैं, जैसे कि अंधापन, बहरापन, छोटे मस्तिष्क के कारण मानसिक कमी, दोषपूर्ण हृदय, फटे ओंठ, खंड तालु, अपसामान्य आंत्र-पथ (इन्टेस्टाइनल-ट्रैक्ट), और स्पाइना बिफिडा अर्थात् मेरुरज्जु और तंत्रिकाओं का खुला रहना। इनकी उग्र दशा में तो शीघ्र ही मृत्यु भी हो सकती है। (चित्र 21.5)। फार्म के प्राणियों में कई वाइरस या विषाणु और बैक्टीरिया या जीवाणु (जैसे संक्रामक गर्भस्राव या ब्रूसेलोसिस; विब्रियोसिस; लेप्टोस्पाइरोसिस), करीब 30% भ्रूणों की मृत्यु तथा गर्भपात करते हैं। मानव में माता के

चित्र 21.5 : **स्पाइना बिफिडा** का रोगी (अनावृत मेरुरज्जु और तंत्रिकाएँ)। यह परिवर्धन सम्बन्धी दोष है जो गर्भावस्था में माता के जर्मन मीजल्स द्वारा संक्रमित होने से होता है।

सिफिलिस वाले रोगाणु (जर्म) गर्भ के परिवर्धन के दौरान उस पर असर डालकर मृतजन्म या जन्मजात (कौनजेनाइटल) अपसामान्यताएँ उत्पन्न कर सकते हैं।

गर्भो में कई रसायन भी अपसामान्यताएं उत्पन्न करते हैं। ऐसे पदार्थों में कई उत्परिवर्तनजन आते हैं जैसे—नाइट्रोजन मस्टर्ड तथा ट्रिपैन ब्लू और उपापचयी संदमक (मेटाबोलिक इनहिबिटर), जैसे—अमीनोप्टेरीन तथा ऐन्टी-फोलिक एसिड यौगिक। आरम्भिक गर्भावस्था के दौरान यदि सगर्भ स्त्री प्राणियों को कॉर्टिसोन तथा विटामिन ए सरीखे कुछ हॉरमोन अधिक मात्रा में दिए जाते हैं तो इससे भ्रूण में कई दोष उत्पन्न हो जाते हैं। ऐसे दोष ये हैं—हाइड्रोसेफैलस (सिर का बहुत अधिक बड़ा होना), **स्पाइना बिफिडा** (द्विशाखित मेरु), **एमट्रोमीलिया** (बाहु की अनुपस्थिति), **फोकोमीलिया** (टाँगों या बाहुओं का न होना और पाँवों तथा हाथों का धड़ से जुड़ा होना), **खंड तालु**, फटे ओंठ आदि। पारे (मरकरी) के विषाक्तन से गर्भ में **प्रमस्तिष्क घात (सेरीब्रल पाल्सी**— मस्तिष्क में हानि पहुँचने से हुआ अंगघात) हो सकता है। ऐसा तभी होता है जब गर्भवती स्त्री पारे से संदूषित भोजन करती है। औद्योगिक मल पदार्थों से निकला हुआ यह पारा कभी मानव भोजन में रल-मिल सकता है।

माताओं के द्वारा ली जाने वाली दवाओं विशेषकर गर्भावस्था के पहले बारह हफ्तों में, से भी गर्भ को हानि पहुँच सकती है। इन दवाओं में कुछ ये हैं—मलेरिया के उपचार के लिए ली जाने वाली **क्विनाइन**, ल्यूकेमिया के उपचार के लिए ली जाने वाली **बुसल्फान**, हॉजकिन रोग के उपचार में ली जाने वाली **क्लोरम्ब्यूसिल**, गर्भपात के उपचार के लिए ली जाने वाली अमीनोप्टेरिन आदि। थैलिडोमाइड नाम का प्रशान्तक (ट्रैंक्विलाइजर) गर्भवती महिलाओं को गर्भावस्था के चौथे से लेकर सातवें हफ्ते के दौरान कै कम करने के लिए दिया जाता है। लेकिन इसके प्रयोग से भयंकर परिणाम देखने को मिले हैं क्योंकि जर्मनी, इंगलैन्ड, कैनाडा और संयुक्त राष्ट्र अमरीका में इसके कारण हजारों ऐसे बच्चे उत्पन्न हुए जो बिना हाथों और टाँगों के थे (चित्र 21.6)।

एक्स-किरणें और अन्य प्रकार के विकिरण परिवर्धन सम्बन्धी कई गड़बड़ियाँ पैदा कर देते हैं, जो प्रत्यक्ष या

चित्र 21.6 : **फोकोमीलिया** (जिसमें पादों की लम्बी हड्डियों का परिवर्धन नहीं होता और हाथ तथा पाँव धड़ से सीधे ही जुड़े होते हैं) का रोगी। माता द्वारा गर्भावस्था की आरम्भिक अवस्थाओं में थैलिडोमाइड लेने से यह दोष उत्पन्न हुआ।

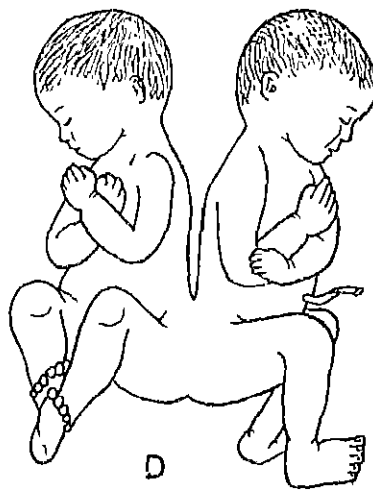
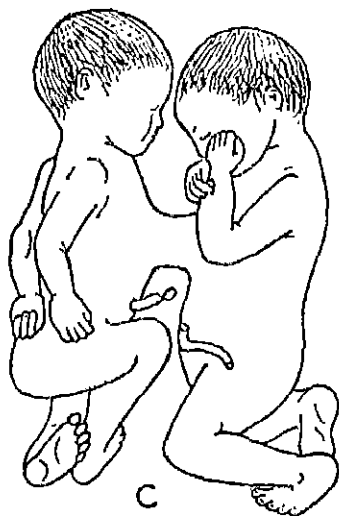
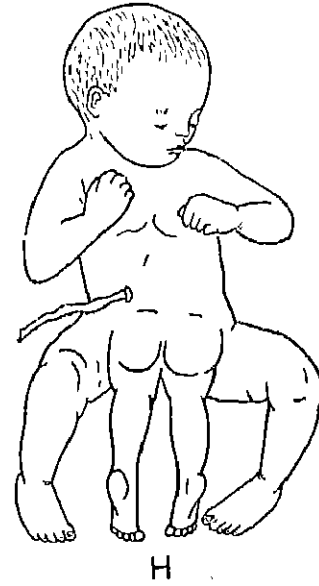
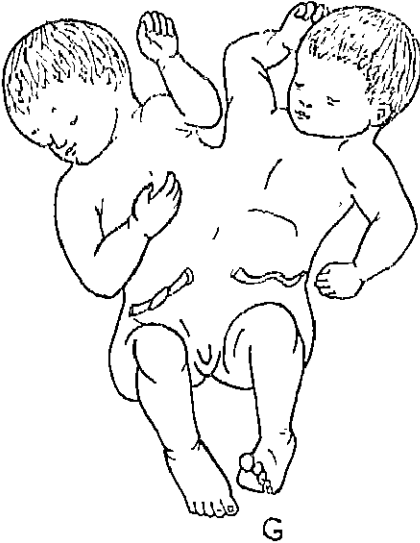
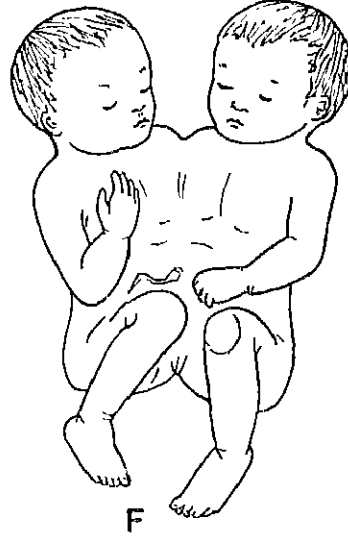
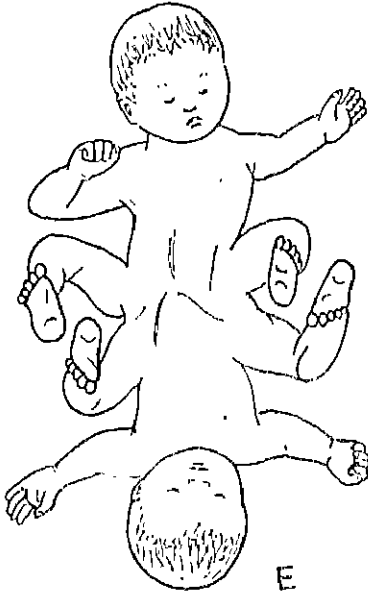
आनुवंशिक हो सकती है। विकिरणों से गर्भ की जनन-कोशिकाओं पर असर पड़ सकता है। इस प्रकार का नुकसान कई पीढ़ियों के बाद प्रकट हो सकता है जो उत्पन्न होने वाली संतान में एकदम प्रकट नहीं होता। प्रत्यक्ष प्रभावों में वे नुकसान या दोष सम्मिलित हैं जो गर्भ के किसी भाग में होते हैं और जो रोगाणुओं, रसायनों और दवाओं के प्रभावों के समान हो सकते हैं। यदि गर्भवती स्त्री का एक्स-रे लिया जाना है तो विकिरण से बचाने के लिए गर्भ की रक्षा के लिए उसे सावधानी पूर्वक तदनुसार रक्षी आवरण से ढक लिया जाना चाहिए। यह बात ध्यान देने योग्य है कि तरुण कोशिकाएँ, ऊतक

और अंग एक्स-किरणों तथा अन्य विकिरणों के प्रति बहुत अधिक संवेदनशील होते हैं।

### (3) कुपोषण के कारण होने वाला अपसामान्य परिवर्धन

चूहे, खरगोश सरीखे प्रयोगशाला वाले स्तनियों तथा कई अन्य प्राणियों में भी यदि गर्भवती स्त्री को विटामिन ए, बी और डी की कमी वाला भोजन दिया जाए तो इससे बहुत दोषपूर्ण संतान उत्पन्न होती हैं। ऐसे दोष हैं **फटे ओंठ, खंड तालु, स्पाइना बिफिडा, लम्बी हड्डियों, मेरुदंड तथा खोपड़ी के कंकालीय दोष, आँखों के दोष, मस्तिष्क के दोष** आदि। संभवतया मानव में भी गर्भवती माताओं के आहार में इन कमियों से गर्भ को ऐसे ही नुकसान पहुँच सकते हैं। हमारे देश के लिए यह विशेष महत्वपूर्ण है जहाँ काफी प्रतिशत लोगों में कुपोषण का होना यहाँ तक कि प्रायः भूखा रहना आम बात है।

#### यमज या जुड़वाँ (ट्विन्स)

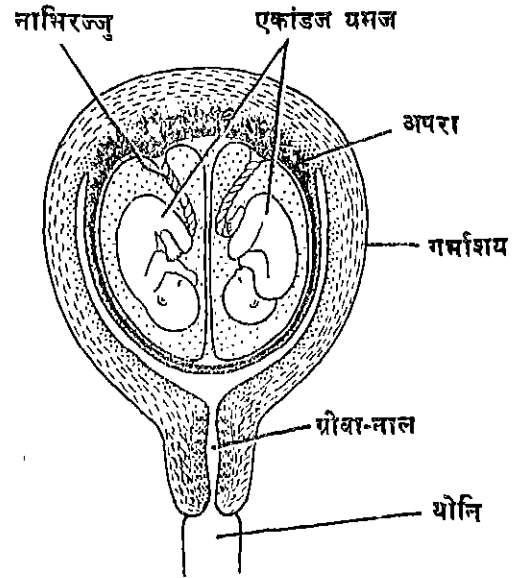
सामान्यतः कोई स्त्री एक बार में केवल एक शिशु को ही जन्म देती है लेकिन कभी-कभी स्त्री द्वारा एक बार में

चित्र 21.7 : संयुक्त (कनज्वाइन्ड) यमजों के विविध प्रकार (पृष्ठ 133 पर भी) ।

एक से अधिक बच्चे भी उत्पन्न किए जाते हैं। ये **बहु-शिशु जन्म (मल्टिपल बर्थ्स)** के उदाहरण हैं। **बहु शिशु जन्म** में आमतौर पर बच्चों की संख्या दो होती है और इस तरह साथ-साथ पैदा हुए बच्चे यमज या जुड़वाँ कहलाते है। लेकिन यह संख्या 3 (ट्रिप्लेट्स), 4 (क्वाड्रुप्लेट्स) 5 (क्विंटाप्लेट्स) या इससे भी अधिक हो सकती है। कम

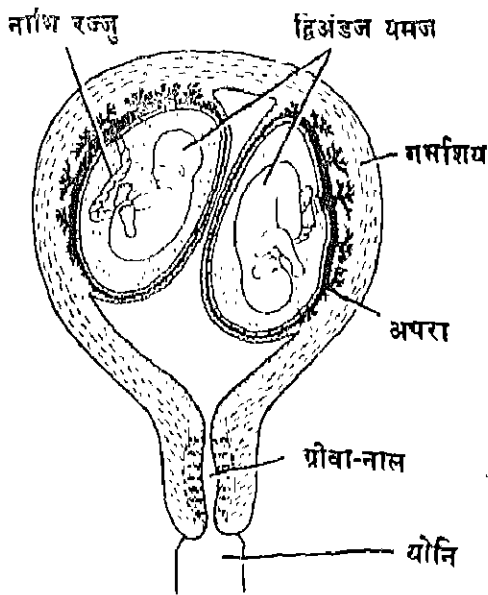
से कम एक उदाहरण ऐसा मालूम है जिसमें एक माता से एक बार में 11 बच्चे उत्पन्न हुए। बहु शिशु जन्म या बहु शावक जन्म अन्य प्राणियों में भी होता है। इस तरह पशुओं (गाय, भेड़, बकरी आदि) में, जो सामान्यतः एक बार में एक बच्चा पैदा करते हैं, कुल के लगभग 5% मौकों पर जुड़वाँ पैदा हो सकते हैं।

यमज या जुड़वाँ आकृति और परिवर्धन में प्रायः पूरी तरह से सामान्य होते हैं। लेकिन कुछ जुड़वाँ बहुत अपसामान्य भी हो सकते हैं। संक्षेप में कहें तो कह सकते हैं कि इनमें हर प्रकार की अपसामान्यताएँ हो सकती हैं। कुछ ऐसे यमजों को संयुक्त यमज (कनज्वाइन्ड ट्विन्स) कहा जाता है। (चित्र 21.7)। ऐसे अधिकांश यमज जिन्दा नहीं रहते और ऐसे संयुक्त यमजों के परिरक्षित नमूने (प्रीजर्व्ड स्पेसीमिन) किसी मेडिकल कालेज या बड़े अस्पताल के म्यूजियम में देखे जा सकते हैं।

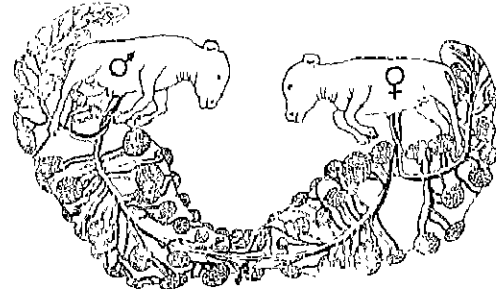
*यमज* ***एकांडज (मोनोज़ाइगोटिक)*** *अथवा* ***द्विअंडज*** **(डाइज़ाइगोटिक)** हो सकते हैं।

**एकांडज यमज :** इस प्रकार के यमज बिल्कुल एक ही अंडाणु से परिवर्धित होते हैं जो निषेचन के बाद युग्मनज (ज़ाइगोट) बनाता है। युग्मनज में विदलन होता है और कोरकपुटी (ब्लैस्टोसिस्ट) बनती है। इस समय कुछ परिस्थितियों के कारण, जिनको अभी पूरी तरह नहीं समझा जा सका है, कोरकपुटी की कोशिकाओं का भ्रूणीय पुंज दो में विभाजित हो जाता है। दोनों भाग एक दूसरे से अलग हो जाते है और इनमें से प्रत्येक एक पूरे काय में परिवर्धित हो जाता है। इन दोनों वर्धमान यमजों का अपरा (प्लैसेन्टा) तो एक ही होता है लेकिन वे उससे जुड़े हुए अलग-अलग रहते हैं (चित्र 21.8)। ये यमज **एकांडज (मोनोज़ाइगोटिक)** कहलाते हैं क्योंकि ये दोनों एक ही युग्मनज से बनी कोरकपुटी के विपाटन (स्प्लिटिंग) से परिवर्धित होते हैं। चूँकि इस प्रकार के यमज एक ही युग्मनज से बनते हैं इसलिए दोनों का आनुवंशिक संघटन बिल्कुल एक ही होता है। यही कारण है कि एकांडज यमज हमेशा एक ही लिंग (सेक्स) के होते हैं, लड़के या लड़कियाँ, और दिखने में, ऊँचाई में और यहाँ तक कि व्यवहार में भी ये समान होते हैं, और

चित्र 21.8 : **एकांडज** या समरूप यमजों के वर्धमान गर्भ।

इसीलिए इनको समरूप या अभिन्न यमज (आइडेन्टिकल ट्विन्स) भी कहा जाता है।

**द्विअंडज यमज :** ये यमज एक ही लिंग (सेक्स) के हो भी सकते हैं और नहीं भी। दिखने, व्यवहार आदि में ये समान नहीं होते और एक दूसरे से सामान्य भाइयों या बहिनों की तरह भिन्न या मिलते जुलते हो सकते हैं, जो कि एक ही जनकों से लेकिन अलग-अलग समय पर पैदा होते है। ऐसे यमजों को सामान्य यमज (फ्रैटर्नल ट्विन्स) कहते हैं। कभी ऐसा होता है कि माता सामान्य रूप से एक अंडाणु के बदले एक बार में दो अंडाणु उत्पन्न करती है। दोनो अंडाणु फैलोपी नलिका में पहुँच कर अलग-अलग निषेचित होकर दो युग्मनज (ज़ाइगोट) बनाते हैं। इन दोनों युग्मनजों में से प्रत्येक एक समूचे व्यक्ति में परिवर्धित होता है। इस तरह सामान्य यमज दो भिन्न-भिन्न युग्मनजों से परिवर्धित होते हैं और इसीलिए **द्विअंडज यमज (डाइज़ाइगोटिक ट्विन्स)** कहलाते हैं (चित्र 21.9)। चूँकि ये भिन्न-भिन्न युग्मनजों से उत्पन्न होते हैं इसलिए अपने आनुवंशिक संघटन में ये भिन्न होते हैं और एक ही लिंग (सेक्स) के हो भी सकते हैं और नहीं भी।

चित्र 21.9 : द्विअंडजी या सामान्य यमजों के वर्धमान (डेवेलपिंग) यमज।

साथ ही ये सामान्य भाइयों व बहिनों की तरह एक दूसरे से भिन्न भी हो सकते हैं और समान भी। अधिकांश **बहुयमज** (मल्टिपल ट्विन्स), त्रिक (ट्रिप्लेटस), चतुष्क (क्वाड्रुप्लेट्स) आदि द्विअंडज प्रकार के होते हैं क्योंकि इनमें प्रत्येक व्यक्ति एक पृथक युग्मनज से उत्पन्न होता है।

**फ्री मार्टिन** : इस बात का वर्णन पहले किया जा चुका है कि पशुओं में द्विअंडज यमजों का होना बहुत असामान्य बात नहीं है। यह पाया गया है कि कभी-कभी दो द्विअंडज यमजों के अपरा, जो उन्हें गर्भाशय से जोड़ते है, आपस में एक दूसरे से ही जुड़ जाते हैं। इसके परिणाम-स्वरूप दोनों गर्भों के बीच रुधिर संवहन-संबंध स्थापित हो जाता है और एक का रुधिर दूसरे से मिल जाता है। यदि ये यमज द्विअंडज होते हैं तो एक गर्भ नर और दूसरा स्त्री होगा। ऐसी दशा में नर गर्भ का कुछ पदार्थ स्त्री गर्भ में पहुँच जाता है जो स्त्री गर्भ के गर्भाशय में अंडाशयों (ओवरी) और अंडवाहिनियों (ओवीडक्ट्स) का परिवर्धन रोक देता है। इस प्रकार स्त्री गर्भ का लैंगिक परिवर्धन गड़बड़ा जाता है जो कुछ-कुछ नर जैसा दिखते हुए वंध्य (स्टेराइल) रहता है (चित्र 21.10)।

चित्र 21.10 : पशुओं के यमजों में से स्त्री सदस्य का फ्री मार्टिन में परिवर्धन। ऐसा नर तथा स्त्री गर्भों के अपरा की रुधिर वाहिकाओं (ब्लड वेसल्स) के परस्पर मिल जाने से होता है। तीर द्वारा मिलने का स्थल दिखाया गया है।

इस प्रकार की स्त्री को फ्री मार्टिन कहते हैं। फ्री मार्टिन वाली दशा गाय, भेड़, बकरी और सूअरों में पाई जाती है। पशुओं में उन 12 मामलों में से 11 में फ्री मार्टिन पैदा होते हैं जिनमें स्त्री गर्भ द्विअंडज यमज के रूप में नर गर्भ के साथ परिवर्धित होता है।

यह बहुत पहले से पता है कि यदि पशुओं में यमज पृथक लिंगों (सेक्स) के हैं तो मादा नर-जैसी और बंध्य होती है। लेकिन इस प्रकार के यमजों के परिवर्धन की सही खोज और उसका वैज्ञानिक वर्णन 1917 ई० में लिली ने किया।

लिली के अनुसार नर गर्भ का प्रभावी हॉरमोन स्त्री गर्भ के हॉरमोन का संदमन करता है जिससे स्त्री गर्भ का लैंगिक परिवर्धन रुक जाता है और उसे आंशिक रूप से नर-जैसा बना देता है।

## अभ्यास

1. उदाहरण सहित समझाओ—(i) मंगोलिज्म, (ii) बहु शिशु जन्म (मल्टिपल बर्थ), (iii) उपापचय के अन्तर्जात दोष ।
2. विरूपताविज्ञान की परिभाषा दो । भ्रूणोद्भव के दौरान अपसामान्य परिवर्धन से मानव शिशुओं में होने वाले छह जन्मजात दोषों को बतलाओ ।
3. समझाओ कि क्यों ?
   (i) *गर्भावस्था के दौरान स्त्रियों को एक्स-रे कराने से बचना चाहिए ।*
   (ii) गर्भवती स्त्रियों को दवाएँ लेने में बहुत सावधान रहना चाहिए ।
   (iii) गर्भवती स्त्रियों के आहार में विटामिन ए, बी और डी की कमी नहीं होनी चाहिए ।
4. भ्रूणोद्भव के दौरान परिवर्तन सम्बन्धी अपसामान्यताओं के तीन कारण क्या हैं ? प्रत्येक पर एक-एक पैरा लिखो ।
5. समरूप (आइडेन्टिकल) और सामान्य (फ्रैटर्नल) यमजों की परिभाषा दो । समझाओ कि मानव में ये कैसे परिवर्धित होते हैं ।
6. लघु टिप्पणियाँ लिखो :
   (i) संयुक्त (कनज्वाइन्ड) यमज,
   (ii) फ्री मार्टिन ।

# अध्याय-23

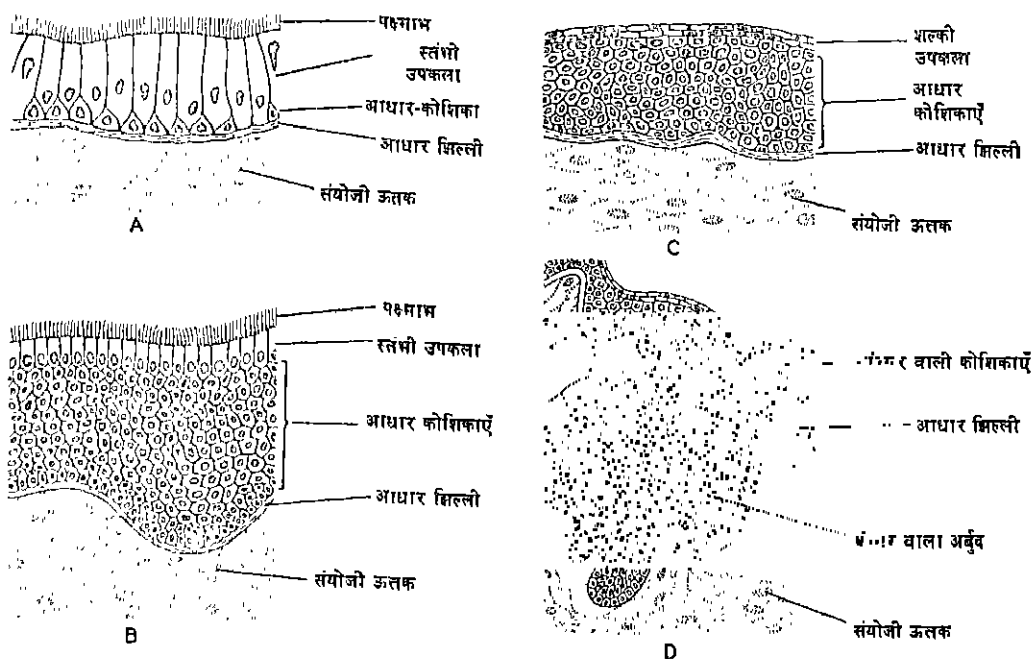
# पुनर्जनन (रीजेनरेशन)

इस बात का संकेत पहले भी दिया गया है कि भ्रूणोद्भव (एम्ब्रियोजेनेसिस) के पूरे होने पर परिवर्धन समाप्त नहीं हो जाता। सभी जीवों में कुछ न कुछ सीमा में भ्रूणोत्तर (पोस्ट-एम्ब्रियोनिक) जीवन में भी परिवर्धन क्षमताएँ बनी रहती हैं। डिम्भकीय और प्रौढ़ जीवन के दौरान जीवों द्वारा इनके कारण खोयी व क्षतिग्रस्त संरचनाओं की बदली या मरम्मत की जा सकती है। अपने जीवन के दौरान जीव टूट-फूट से लगातार कई प्रकार की कोशिकाओं और संरचनाओं को खोता रहता है, इसलिए इनकी बदली की निरन्तर आवश्यकता पड़ती है। शरीर को किसी भी प्रकार की क्षति पहुंच सकती है, जो साधारण सतही घाव के रूप में या कुछ ऊतकों के आंशिक अथवा भीषण प्रकार की विनष्टि के रूप में हो सकती है। लेकिन यह क्षति काफी अधिक भी हो सकती है जिसमें किसी अंग की पूरी या आंशिक हानि या शरीर के किसी बड़े भाग तक की हानि भी हो सकती है। यदि आप मेढक के बैंगची (टेडपोल) या घर की दीवारों वाली छिपकली की पूंछ काटें तो पूंछ के बाकी हिस्से मे खोया हुआ भाग फिर से परिवर्धित कर लिया जाता है। पूंछ के इस बचे हुए भाग के फिर से बढ़ जाने को पुनर्जनन (रीजेनरेशन) कहते हैं।

पुनर्जननन की परिभाषा इस प्रकार होगी—**यह जीव के भ्रूणोत्तर जीवन के दौरान खोई या क्षतिग्रस्त संरचनाओं का बदलाव, मरम्मत या पुनः स्थापना की प्रक्रिया है अथवा शरीर के एक छोटे खंड से पूरे शरीर की पुनर्रचना है।**

खोई हुई संरचनाओं का पुनर्जनन करने की क्षमता सभी प्राणियों में कुछ न कुछ होती है, लेकिन कहाँ पर कितना पुनर्जनन हो सकता है इस सन्दर्भ में भिन्न-भिन्न प्राणियों मे अन्तर जरूर होते है। कुछ में जो कुछ गँवाया या क्षतिग्रस्त होता है उसके लगभग पूरे का पुनर्जनन कर दिया जाता है और अन्य में यह क्षमता सीमित होती है।

अपने भ्रूणोत्तर जीवन में विभिन्न प्राणियों की मरम्मत सम्बन्धी पुनर्जननक्षमता भिन्न-भिन्न होती है।

अकशेरुकियों में **केंचुआ** (अर्थवर्म) और कई अन्य **लघुवलयक** या ऐनेलिड प्राणी शरीर के अग्र (अगले) या पश्च (पिछले) सिरे से निकाले गए कुछ खंडों का फिर से निर्माण करने की क्षमता रखते है। कुछ मृदुकवची या मोलस्क प्राणी नेत्र-वृन्तों, आंखों, पैर व सिर के भागों का पुनर्जनन करने की क्षमता रखते हैं। कीटों सहित कई संधिपादों (आर्थोपोडों), **पतकवचियों** या **क्रस्टेसिया प्राणियों** तथा **मकड़ियों (स्पाइडर)** में पादों का पुनर्जनन कर लिया जाता है। **तारामीन** या **स्टारफिश** और अन्य **इकाइनोडर्म** प्राणियों में भुजाओं का पुनर्जनन कर लिया जाता है। होलोथूरियाई (होलोथूरियन) इकाइनोडर्म प्राणियों में **शारीर** (ऐनाटमी) की एक अजीब परिघटना पाई जाती है। इसमें ये प्राणी खतरे की स्थिति में अपने

चित्र 22.1 : फेफड़े की उपकला पर धूम्रपान का प्रभाव—(A) सामान्य फेफड़े की उपकला, (B) तथा (C) धूम्रपान करनेवालों में पाई जाने वाली फेफड़े की उपकला में अपसामान्य परिवर्तनों की दो अवस्थाएँ, (D) फेफड़े के ऊतक में वृद्धि करने वाला उपकला का कैन्सरमय अर्बुद।

है और कहा जाता है कि कश्मीरियों में प्रायः उदर की त्वचा के कैन्सर होने का शायद यही कारण हो। सारे भारत में पान और तम्बाकू चबाना व खाना एक आम बात है, इसलिए अपने देश में मुँह के कैन्सर होने का क्या पता यही कारण हो क्योंकि पान व तम्बाकू से मुख-उपकला (एपिथीलियम) का उत्तेजन होता है। बहुत अधिक धूम्रपान से फेफड़ों का उत्तेजन होता है और इसे फेफड़ों के कैन्सर से सम्बद्ध माना जाता है।

(2) कई रसायन कैन्सर प्रेरित करते हैं। इन कैन्सरजनी पदार्थों में निकोटिन, कैफीन, कोयले व तेल के जलने से उत्पन्न पदार्थ, कई बहुचक्री (पॉलीसाइक्लिक) हाइड्रोकार्बन आदि तथा कुछ लैंगिक हॉरमोन और स्टेरॉइड सम्मिलित हैं, यदि इन्हें अधिक मात्रा में दिया जाता है या ये अधिक मात्रा में उत्पन्न होते हैं।

(3) एक्स-किरणें, परा-बैंगनी (अल्ट्रा-वायलेट) किरणें और अन्य आयनकारी विकिरण (आयोनाइजिंग रेडिएशन)।

(4) **विषाणु या वाइरस।**

यद्यपि कई रसायन और अन्य कारक कैन्सर उत्पन्न करने में सक्षम होते हैं तो भी इस कैन्सरजनी विशेषता के पीछे क्या कारण और सिद्धांत है वह स्पष्ट नहीं है।

कैन्सर केवल मानव में ही नहीं होता। यह अन्य कई स्तनियों और निम्नतर कशेरुकियों आदि में होता है, यहाँ तक कि कीटों में भी। कैन्सर वाली रचनाएँ पौधों में भी होती है लेकिन इनमें वे जीवाणुओं यानी बैक्टीरिया के संक्रमण (इनफैक्शन) से होती हैं। बैक्टीरिया द्वारा प्राणियों में कैन्सर होना नहीं पाया गया है।

### कैन्सर-कोशिकाओं के आधारभूत लक्षण

किसी भी ऊतक की कोई भी कोशिका, जो कि समसूत्रीविभाजन करने में सक्षम होती है, कैन्सर वाली हो सकती है। कैन्सर-कोशिकाएँ सामान्य कोशिकाओं से कई बातों में अलग पहचानी जा सकती हैं, जैसे कि अनियंत्रित समसूत्रीविभाजन में और कोशिकाओं की संरचनाओं तथा उपापचयी प्रक्रिया के परिवर्तन में।

कोशिका-विभाजन द्वारा वृद्धि होना परिवर्धन का सामान्य लक्षण है और अधिकांश ऊतकों में यह जीवन पर्यन्त होता रहता है। यही वह प्रक्रिया है जिसके द्वारा कोई जीव निरन्तर अपनी पुरानी व जर्जर कोशिकाओं को नई कोशिकाओं से बदलकर अपने ऊतकों को क्रियाशीलता की उपयुक्त दशा में बनाए रखता है। लेकिन सामान्य परिवर्धन भिन्न इसलिए है कि वह *व्यवस्थित और सुसंगठित वृद्धि है। किसी अवस्था में* कोशिका का विभाजन रुक जाता है और कोशिका विभेदन वाली प्रावस्था में आ जाती है। कोशिका-विभाजन का यह नियंत्रण सभी ऊतकों पर खरा उतरता है और जीवन की भ्रूणीय तथा भ्रूण के बाद वाली अवस्थाओं में यह सामान्य परिवर्धन का संलक्षण है। अभी तक स्पष्ट रूप से हमें यह मालूम नहीं है कि कोशिका-विभाजन का नियमन कौन-सा कारक या कौन-से कारक करते हैं, लेकिन यह होता है, यह एक स्थापित तथ्य है।

कैन्सर वाली कोशिकाओं के और सामान्य कोशिकाओं के कोशिका-विभाजन का गुण और विधि एक ही है। सामान्य कोशिकाओं की अपेक्षा कैंसर-कोशिकाएँ धीमी या तेज दर से विभाजित होती हैं। लेकिन कैंसर-कोशिकाएँ अनियंत्रित रूप में विभाजित होती हैं, जिनका परिणाम यह होता है कि कैंसर कोशिकाएँ बहुत अधिक संख्या में उत्पन्न हो जाती हैं, इसलिए अर्बुद का आकार बढ़ता ही रहता है। लगातार उत्पन्न होने वाली कन्सरमय संतति-कोशिकाएँ (डॉटर सेल्स) कभी विभेदित नहीं होतीं और आस-पास के क्षेत्रों पर आक्रमण करना शुरू कर देती हैं। ये कोशिकाएँ अन्य क्षेत्रों में पहुँचने के लिए अंततः प्राथमिक अर्बुद से अलग हो जाती हैं, और यहाँ भी उनका विभाजन चलता रहता है और फिर द्वितीयक अर्बुद बन जाते हैं।

*अंतः कैन्सर की परिभाषा इस प्रकार की जा सकती है*—यह **अव्यवस्थित व असंगठित वृद्धि है जिसमें नियंत्रणकारी और नियमनकारी प्रक्रिया गायब या प्रभावहीन हो जाती है।**

इस बात को समझाने के लिए दो संकल्पनाएँ प्रस्तुत की गई हैं कि एक सामान्य कोशिका कैसे कैन्सर वाली कोशिका में बदल जाती है :

(क) एक संकल्पना के अनुसार कैन्सर अनिवार्य रूप से एक या अधिक गुणसूत्रों में परिवर्तन होने या कायिक (सोमैटिक) कोशिकाओं के केन्द्रकों में जीनउत्परिवर्तन होने के कारण होता है।

(ख) दूसरी संकल्पना के अनुसार यह जरूरी नहीं कि आनुवंशिक (जीनेटिक) परिवर्तन एक अनिवार्य कारक हो। इसके अतिरिक्त कोशिकाद्रव्य (साइटोप्लाज्म) में ही कोई परिवर्तन होता है जिसके परिणामस्वरूप केन्द्रकीय और कोशिकाद्रव्यी विभाजनों पर नियंत्रण समाप्त हो जाता है।

## अभ्यास

1. परिभाषा दो : (i) कैन्सरजनी (कार्सिनोजेनिक), (ii) सुदम (बेनाईन) अर्बुद, (iii) कैंसरी-अर्बुद, (iv) दुर्दमता (मैलाइनेन्सी) या कैंसर।
2. बताओ क्यों—

   (i) स्वास्थ्य के लिए अति धूम्रपान हानिकारक है ?

(ii) कश्मीरियों में उदरीय त्वचा का कैंसर प्रायः अधिक होता है?
(iii) पान और तंबाकू चबाने की आदत हानिकारक है ?

3. विविध कैंसरजनी कारकों के नाम बताओ ।
4. कैंसर वाली कोशिकाओं की मूलभूत विशेषता क्या है जिससे वे सामान्य कोशिकाओं से भिन्न होती हैं ?
5. समझाओ कि एक सामान्य कोशिका किस प्रकार कैंसर-कोशिका में बदल जाती है, और इस प्रसंग की क्या संकल्पनाएँ हैं ।

# अध्याय-22

# कैन्सर

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दुर्दमता (मैलाइनेन्सी) या कैन्सर एक प्रकार का अपसामान्य परिवर्धन है, जो प्रौढ़ जीवन के दौरान होता है और सामान्य कोशिकाओं को कैन्सर-कोशिकाओं में बदल देता है। कैन्सर एक प्रकार का अर्बुद (ट्यूमर) है जिसका अर्थ है कुछ कोशिकाओं के असीमित और निरंतर विभाजन के कारण किसी ऊतक की अपसामान्य वृद्धि या विवर्धन। इस प्रकार का परिवर्धन प्रायः 35-40 साल की उम्र के बाद होता है लेकिन यह कम उम्र में भी हो सकता है। सामान्यतः कैन्सरी अर्बुद कुछ समय मंद वृद्धि वाले गुप्तकाल (लेटेन्ट पीरियड) से होकर गुजरता है जब कि लक्षण बहुत स्पष्ट नहीं होते। लेकिन बाद मे वृद्धि बहुत तेजी से होती है, प्रायः 50 की उम्र के बाद, और इससे बहुधा व्यक्ति की मृत्यु हो जाती है।

अर्बुद शरीर की सतह पर या उसके अन्दर कहीं भी परिवर्धित हो सकते हैं। लेकिन सभी अर्बुद कैन्सरी नहीं होते। अर्बुदों के दो सामान्य प्रकार पहचाने गए हैं : (i) सुदम (बेनाइन या नॉन-मैलाइनेन्ट), और (ii) कैन्सरमय या दुर्दम (मैलाइनेन्ट)

**सुदम (बेनाइन)** अर्बुद धीरे-धीरे वृद्धि करता है लेकिन यह बहुत बड़ा भी हो सकता है। यह निश्चित रूप से अपने मूल स्थान पर ही सीमित रहता है और शरीर के किसी भी अन्य भाग पर नहीं फैलता। यह कैन्सर उत्पन्न नहीं करता। अधिकांश अर्बुद (ट्यूमर) इसी प्रकार के होते हैं।

**कैन्सरमय (दुर्दम) अर्बुद** भी पहले पहल तो एक छोटी रचना के रूप में आरम्भ होता है, जैसे कि शरीर में कहीं पर वर्णकित या काले तिल के रूप में या वक्ष में एक छोटे उभार के रूप में। पहले यह धीरे-धीरे वृद्धि करता है लेकिन बाद में बड़ी तेजी से वृद्धि करने लगता है। अन्त में अर्बुद आस-पास के ऊतकों में पेड़ की जड़ों की तरह फैलने लगता है। आखिरी अवस्था तब आती है जब कि अर्बुद की कोशिकाएँ उससे बिखर कर रुधिर या लसीका (लिम्फ) के प्रवाह के साथ शरीर के अन्य अंगों में पहुँच जाती हैं। वहाँ वे जमा होती जाती हैं और द्वितीयक अर्बुदीय रचनाएँ बना देती हैं। यह अवस्था **अपररूपान्तरण (मेटास्टेसिया)** कहलाती है। यह अवस्था घातक होती है जिसमें जल्दी या विलम्ब से व्यक्ति की मृत्यु हो जाती है

## कैन्सर उत्पन्न करने वाले कारक

यद्यपि अभी तक यह स्पष्ट नहीं है कि कैन्सर होने का कारण क्या है लेकिन तब भी अब कई तथ्य ज्ञात हो गए हैं जो कि कैंसर उत्पन्न करने वाले या **कैन्सरजनी (कार्सिनोजेनिक)** हैं। ये निम्नलिखित प्रकार से हैं :

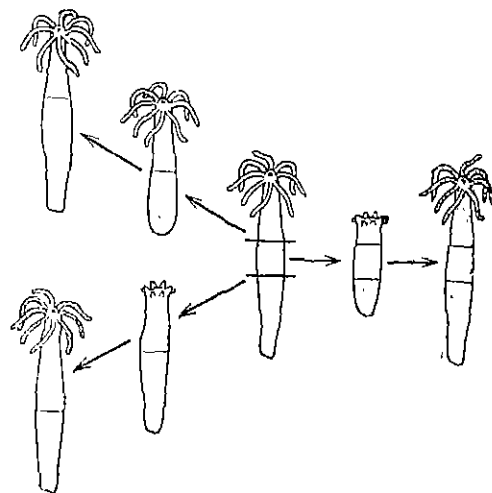
(1) किसी ऊतक में शारीरिक दृष्टि से चिरकारी (क्रोनिक) उत्तेजन (इरिटेशन) कैन्सर का कारण हो सकता है। उदाहरण के लिए, जाड़ों के दौरान कश्मीरी लोग अपने को गर्म रखने के लिए कपड़ों के नीचे उदर के ऊपर जलते कोयलों की अंगीठी (कांगड़ी) रखते हैं। इससे उदर की त्वचा पर निरन्तर उत्तेजन होता रहता

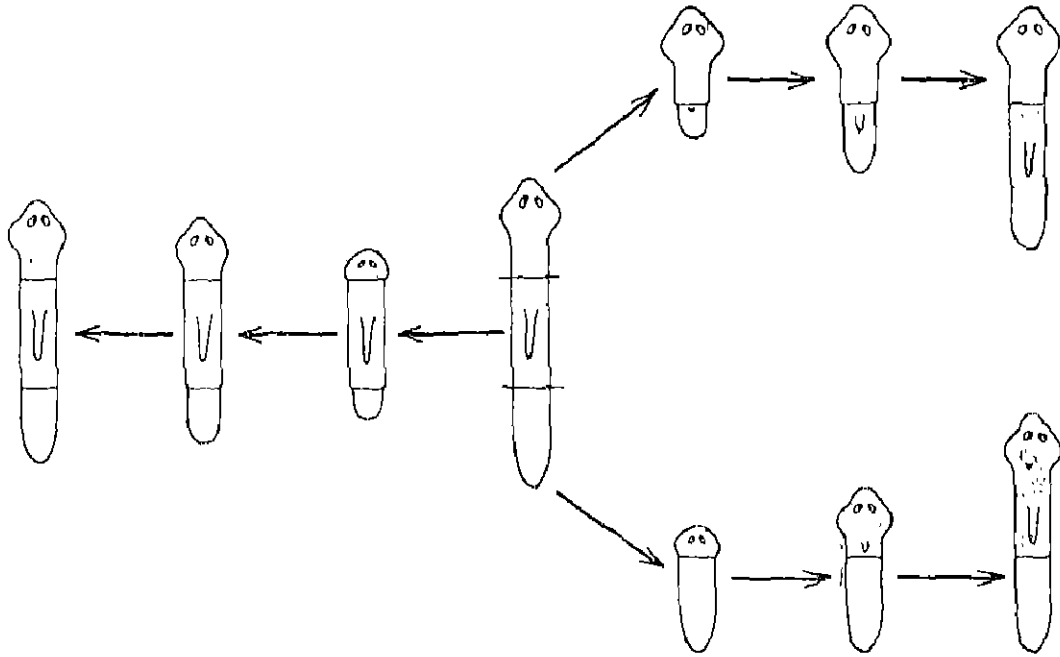
सारे अंतरंग (विसेरा) बाहर फेंक देते हैं और फिर पुनर्जनन कर लेते है।

कशेरुकियों में अंगों के पुनर्जनन की सबसे अधिक क्षमता **सैलामैन्डर, ऐक्सोलॉटल सरीखे यूरोडील जलस्थलचरों** (एम्फीबियन) में पाई जाती है। ये पाद, पूंछ, जबड़े, आंत्र, बाहरी क्लोम (गिल) और रेटीना का जीवन पर्यन्त पुनर्जनन कर सकते है। इनमें से कुछ तो आँख के लैन्स का निर्माण तक फिर से कर सकते हैं। **ऐनूरन जलस्थलचरों**, जैसे कि **मेढक** और भेकों (टोडों) में बैंगची द्वारा पूंछ का फिर से निर्माण कर लिया जाता है। काटने पर पश्च पादों का भी फिर से निर्माण कर लिया जाता है, यदि बैंगची (टेडपोल) काफी तरुण है। ऐनूरा समूह के अधिकांश प्रौढ़ जलस्थलचरों में पादों के पुनर्जनन की क्षमता नहीं होती। **लैम्प्री के ऐम्मोसीट लार्वा** और कुछ छिपकलियों में पूँछ का पुनर्जनन होता है। छिपकलियाँ स्वांगोच्छेदन (ऑटोटामी) का प्रदर्शन यानी प्रयोग भी करती हैं। वे शत्रु द्वारा आक्रमण किए जाने पर अपनी पूँछ वहीं छोड़ देती हैं और फिर उसका निर्माण कर लेती है। कुछ **मछलियों** और **पक्षियों** में क्रमशः पखों (फिन) तथा चोंचों का पुनर्जनन होता हुआ पाया जाता है।

**स्तनियों** (मैम्मल्स) में बाहरी भागों का पुनर्जनन नहीं होता लेकिन इन प्राणियों में यकृत् (कलेजा) का पुनर्जनन करने की भारी क्षमता होती है। यदि यकृत के भाग को निकाल दिया जाए तो कोशिकाओं का विभाजन लगातार तब तक होता रहता है जब तक कि मूल बाकी भाग के ऊतक की पूरी पुनर्रचना नहीं हो जाती। लेकिन यकृत् अपनी सामान्य (पुरानी) आकृति में नहीं आ पाता। इसी तरह यदि एक वृक्क या गुर्दे को निकाल दिया जाए तो दूसरा वृक्क आकार में बड़ा होकर खोए हुए वृक्क का भी कार्य करता है। इस प्रकार का मरम्मती पुनर्जनन **क्षतिपूरक अतिवृद्धि (कम्पेनसेटरी हाइपरट्रॉफी)** कहलाता है।

यह (उदाहरण के लिए) मेढक के बैंगची के पाद के पुनर्जनन से भिन्न है जिस में पुनर्जनित भाग आकृति तथा कार्य दोनों में निकाले गए भाग के बिलकुल समान होता है।

मूल शरीर के एक छोटे व अलग किए गए खंड से समूचे भाग की पुनर्रचना करने की क्षमता प्राणियों के केवल कुछ समूहों में ही पायी जाती है; जैसे कि स्पंजों, कुछ सीलेन्टरेट प्राणियों, चपटे कृमियों, नेमर्टिन कृमियों तथा एसीडियन प्राणियों में। हाइड्रा में पुनर्जनन की क्षमता की खोज सबसे पहले 1742 ई० में ट्रेम्ब्ले द्वारा की गई। यदि आप हाइड्रा या प्लैनेरिया (चपटाकृमि) को अनुप्रस्थ प्रकार से दो या अधिक भागों में काटें तो इनमें से प्रत्येक भाग एक पूर्ण जीव में परिवर्धित हो जाता है। (चित्र 23.1,23.2)। ऐसे अनेक प्राणियों में विखंडन और पुनर्जनन अलैंगिक जनन का सामान्य प्रकार है।

चित्र 23.1 : हाइड्रा में पुनर्जनन (रीजेनरेशन)।

कई बातों में पुनर्जनन की प्रक्रिया भ्रूणीय परिवर्धन की प्रक्रिया के समान है। भ्रूणीय परिवर्धन में पुनर्जनन से कोशिका-विभाजन, कोशिका की गतियाँ, कोशिकाओं व ऊतकों के विभेदन तथा रूप परिवर्धन अथवा संरचना विकास की प्रक्रियाएँ सम्बद्ध हैं। पुनर्जनन में कोशिकाएँ भली प्रकार से बने ऊतकों की पहले से ही विभेदित व विशेषीकृत कोशिकाओं के वि-विभेदन (डी-डिफरेंसिएशन) की प्रक्रिया से उत्पन्न होती हैं। पुनर्जनन क्रियाशील प्रौढ़ या डिम्भक के शरीर में होता है और शरीर में विद्यमान हॉरमोनी कारक और तंत्रिक कारक (न्यूरल फैक्टर) पुनर्जनन को प्रभावित ही नहीं करते बल्कि ये उसको संपन्न करने के लिए भी जरूरी हैं।

चित्र 23.2 : प्लैनेरिया नामक चपटे कृमि में पुनर्जनन ।

## अभ्यास

1. पुनर्जनन (रीजेनरेशन) की परिभाषा दो। पुनर्जनन और भ्रूणोद्भव के दौरान की परिवर्धन सम्बन्धी प्रक्रियाओं में जो समानताएँ और असमानताएँ हैं, उनका विवेचन करो।
2. विभिन्न प्राणियों में पुनर्जनन की क्षमता के वितरण पर संक्षेप में प्रकाश डालो।
3. लघु टिप्पणियाँ लिखो :
   (i) वि-विभेदन (डी-डिफरेंसिएशन)।
   (ii) प्र मुकुल या ब्लैस्टीमा।
   (iii) क्षतिपूरक अतिवृद्धि।
   (iv) स्वांगोच्छेदन (ऑटोटामी)।

# अध्याय-24

# कालप्रभावन (एजिंग)

विभिन्न जीवों में औसत जीवन अवधि भिन्न-भिन्न होती है । कुछ बहुत कम समय तक जीते हैं तो कुछ कई दशकों या सदियों तक जीवित रहते हैं। लेकिन ऐसा कोई जीव नहीं है जो हमेशा ही जिन्दा रहे। कोई जीव भले ही दुर्घटना ग्रस्त न हो, किसी परभक्षी (प्रीडेटर) द्वारा न खाया जाए या किसी मारक रोग से पीड़ित न हो फिर भी बुढ़ापे के अन्तिम परिणाम के रूप में उसकी मृत्यु होती ही है। जैसे-जैसे कोई जीव अधिक उम्र का होता जाता है, वैसे-वैसे उसकी उपापचय (मेटाबोलिज्म) की क्षमता तथा पुरानी जर्जर कोशिकाओं को बदलने और क्षतिग्रस्त भागों के मरम्मत करने की क्षमता धीरे-धीरे कम होती जाती है । जीवों में कोशिकाओं, ऊतकों और अंगों की कार्य-क्षमता और बाहर के संक्रमण का सामना करने और उसे दूर करने की क्षमता धीरे-धीरे कम होती जाती है। अन्ततः महत्वपूर्ण अंग—जैसे कि हृदय, वृक्क (गुर्दे), मस्तिष्क अथवा यकृत् आदि बिल्कुल कार्य करना बन्द ही कर देते हैं जिसके फलस्वरूप शरीर के अन्य भागों की मृत्यु के साथ ही जीव की भी मृत्यु हो जाती है। उम्र बढ़ने के साथ-साथ जो परिवर्तन दिखलाई देते हैं उन्हें ही मिले-जुले रूप मे **कालप्रभावन** (एजिंग) कहते हैं जो सभी जीवों में होते हैं और जिनका परिणाम होता है अंत में मृत्यु ।

**वयोवृद्ध होने या कालप्रभावन(एजिंग) की परिभाषा इस तरह की जा सकती है—वह प्रक्रिया, जिसमें जीव की उम्र अधिक होने के साथ-साथ उसकी कोशिकाओं, ऊतकों व अंगों की संरचना और कार्य में दिन-ब-दिन अवनति होती जाती है** । परिवर्धन सम्बन्धी वह क्षेत्र जो काल-प्रभावन की प्रक्रियाओं के अध्ययन से सम्बद्ध होता है (**जीरन्टोलॉजी**) कहलाता है।

## कालप्रभावन के लक्षण

मानव में कालप्रभावन के लक्षणों से हम सभी परिचित है, जिनमें से कुछ को हम यहाँ उदाहरणों के रूप में प्रस्तुत कर सकते हैं। 30 वर्ष के व्यक्ति की अपेक्षा 70 वर्ष के व्यक्ति में हृदय प्रतिमिनट केवल 65% रुधिर पम्प करता है और मस्तिष्क तथा वृक्कों को जाने वाले रुधिर में क्रमशः 80% और 42% की कमी हो जाती है। 20 साल की उम्र में रुधिर फेफड़ों से प्रति मिनट करीब 4 लिटर ऑक्सीजन लेता है लेकिन 75 साल की उम्र में इतने समय में रुधिर करीब 1.5 लिटर ऑक्सीजन ही लेता है । उम्र के साथ-साथ वृक्क-नलिकाओं की संख्या करीब आधी और जीभ में स्वाद-कलिकाओं (टेस्ट बड्स) की संख्या तरुण मानव की अपेक्षा करीब एक तिहाई हो जाती है। अस्थि-मज्जा (बोन मैरो) से नए रक्ताणुओं (एरिथ्रोसाइट) का उत्पादन कम हो जाता है, कोशिकाएँ पानी रोक रखने में कम से कम सक्षम होती जाती हैं, रुधिर का आयतन कम हो जाता है और ऊतक सूखने लगते है। इसका परिणाम यह होता है कि वृद्ध व्यक्ति में चमड़ी सूखी व झुर्रीदार, पेशियाँ ढीली व झुर्रीदार, हड्डियाँ भंगुर

(ब्रिटल), रुधिर परिवहन कम, मूत्र का बनना कम और शरीर दुबला, निस्तेज और झुका हुआ होता जाता है। उम्र बढ़ने के साथ-साथ अन्य प्राणियों में भी इसी तरह के परिवर्तन होते है ।

कालप्रभावन के बाहरी लक्षण भी प्रकट होने लगते हैं जिनका पता आसानी से लगाया जा सकता है। ये परिणाम कोशिकाओं के अन्दर और उनके बाहर शरीर के ऊतकों में अंतराकोशिक अवकाशों (इंटरसेल्युलर स्पेस) में होने वाले परिवर्तनों के कारण होते हैं और इनकी खोज करना आसान नहीं है । उम्र बढ़ने के साथ-साथ कई प्राणियों के विभिन्न ऊतकों में कई कोशिकीय और कोशिका-बाह्य (एक्स्ट्रा सेल्युलर) परिवर्तन देखे गए है।

**कोशिकीय परिवर्तन :** इनके अंतर्गत शरीर की कोशिकाओं के केन्द्रकों के गुणसूत्री विपथन (एबेरेशन) और जीन-उत्परिवर्तन (कायिक उत्परिवर्तन) हैं, जिनकी वजह से डी०एन०ए० की बनावट को गड़बड़ी पहुँचना जरूरी है। उदाहरण के लिए—चूहों, कुत्तों और मानव में उम्र के साथ-साथ गुणसूत्रों की गड़बड़ियाँ भी बढ़ती जाती हैं। चूहों की यकृत् कोशिकाओं के संदर्भ में पाया गया है कि प्राणी की उम्र बढ़ने के साथ-साथ ऐल्डोलेस नामक एंजाइम अक्रिय होता चला जाता है। साथ ही वृद्ध प्राणियों की कोशिकाओं में दोषपूर्ण प्रोटीनों की मात्रा अधिक हो जाती है। अधिक उम्र वाले प्राणियों की कोशिकाओं में एक वर्णक (पिगमेंट) अधिक मात्रा में जमा होता जाता है, विशेषकर उन ऊतकों में जिनकी कोशिकाएँ जल्दी ही विभाजन करना बन्द कर देती हैं, जैसे कि मस्तिष्क और पेशियों की कोशिकाओं में यह वर्णक संभवतया माइटोकॉण्ड्रिया जैसे पुराने जर्जर अंगकों (ऑर्गेनेल) के अवशेषों का प्रतिनिधित्व करता है।

कोशिकाएँ अवश्य ही कालप्रभावित होती हैं यह पात्रे में (इन विट्रो) संवर्धित की गई मानव-कोशिकाओं के हाल के अध्ययन से प्रदर्शित हो जाता है। यह पाया गया है कि मानव गर्भ के फेफड़ों से ली गई कोशिकाएँ केवल 50 बार विभाजित होती हैं और फिर वे अपना ओज (विगर) खोकर मृत हो जाती हैं। वृद्ध व्यक्तियों की कोशिकाएँ कम बार विभाजित होती हैं। विभिन्न प्रकार की कोशिकाएँ भिन्न-भिन्न समय पर विभाजन करना बन्द करती हैं और लगता है कि उनमें भी भिन्न-भिन्न दरों वाले परिवर्तन होते है ।

**कोशिकाबाह्य (एक्स्ट्रासेल्युलर) परिवर्तन :** सभी ऊतकों में अन्तराकोशिक अवकाश कोशिकाओं से स्रावित विविध पदार्थों से भरे रहते हैं, जैसे कि पॉलीसैक्कराइड, और कॉलैजेन तथा इलेस्टिन समेत तंतुमय प्रोटीन । इन पदार्थों में आमतौर से पाया जाने वाला पदार्थ कॉलैजेन है, जो शरीर के कुल प्रोटीन अंश का 40%होता है। उम्र सम्बन्धी परिवर्तनों की दृष्टि से कॉलैजेन का अधिक अध्ययन किया गया है और इसके कई गुणों से पता चलता है कि यह कोशिकाओं की कालप्रभावन की प्रक्रिया और शरीर से महत्वपूर्ण रूप से सम्बद्ध हो सकता है ।

तरुण उम्र का कॉलैजेन पारगम्य (परमिएबुल), लचीला और आसानी से विलेय होता है लेकिन उम्र के साथ यह कम पारगम्य, कड़ा और अविलेय हो जाता है जिस कारण कोशिकाओं के लिए उसका हानिकारक होना स्वाभाविक है । आस-पास के कॉलैजेन में इन परिवर्तनों के कारण पदार्थों और ऑक्सीजन का कोशिकाओं में विसरण करना और नाइट्रोजनीय वर्ज्य पदार्थों तथा कार्बन-डाई-ऑक्साइड का उनसे बाहर निकलना कठिन हो जाता होगा । इस प्रकार काल प्रभावित कॉलैजेन के कारण होने वाले यांत्रिक अवरोध के फलस्वरूप कोशिकाओं से बाहर व भीतर होने वाले विसरण की कमी से ही महत्व-पूर्ण अंगों समेत विभिन्न ऊतकों की कोशिकाओं में अवनति और काल प्रभावन होने लगता है ।

**काल प्रभावन सम्बन्धी सिद्धान्त :** किसी प्राणी में काल प्रभावन होना ही क्यों चाहिए ? कुछ प्राणी क्यों अधिक तेजी से काल प्रभावन करते हैं और अन्य व्यक्तियों की अपेक्षा उनकी जीवन अवधि छोटी क्यों होती है ? एक ही व्यक्ति में विभिन्न प्रकार की कोशिकाएँ और ऊतक भिन्न-भिन्न दरों से क्यों काल प्रभावित होते हैं ? प्राणी की उम्र के साथ-साथ शरीर की अवनति के प्राथमिक कारण क्या हैं ? काल प्रभावन के दौरान होने वाली प्रक्रियाओं और परिवर्तनों के बारे में हमें अभी तक पर्याप्त जानकारी नहीं है, और इन प्रश्नों तथा अन्य ऐसे ही कई प्रश्नों के संतोषजनक उत्तर अभी हमारे पास नहीं

हैं, इसलिए जीरोन्टोलॉजी के क्षेत्र मे अभी और अधिक खोज और अनुसंधानों की अपेक्षा है।

लेकिन इस बीच काल प्रभावन की परिघटना को समझाने के लिए कई सिद्धान्त प्रस्तुत किए गए हैं।

कुछ जीव विज्ञानियों का कहना है कि जीवों के काल प्रभावन का कारण वातावरण में प्रतिकूल परिवर्तन होना है। अन्य वैज्ञानिक इस बात में विश्वास करते हैं कि कालप्रभावन जीव की कोशिकाओं का नैज (इनट्रींजिक) आनुवंशिक लक्षण है। इन दोनों के बीच के सिद्धान्त के अनुसार काल प्रभावन आनुवंशिक कारकों (जीनों) और वातावरण की आपसी प्रतिक्रिया है। उदाहरण के लिए, हम जानते हैं कि प्राणियों को पालतू बनाने से उनकी जीवन अवधि बढ़ जाती है। एक दूसरे सिद्धान्त के अनुसार उपापचय (मेटाबोलिज्म) की अधिक दर वाली कोशिकाएँ और जीव आपेक्षिक रूप से उपापचयी सक्रियता की कम दर वाली कोशिकाओं और जीवों की तुलना में अधिक तेजी से काल प्रभावित होकर जल्दी मर जाते हैं।

अभी हाल ही में प्रस्तुत **काल प्रभावन के प्रतिरक्षा (इम्म्यूनिटी) सिद्धान्त** के अनुसार मानव में अधेड़ अवस्था के बाद थाइमस ग्रंथि का ह्रास और उसका गायब होना ही काल प्रभावन का प्रमुख कारण है। इस ग्रंथि के गायब होने के साथ ही बाहरी रोगाणुओं आदि के आक्रमण के प्रति शरीर की रक्षा क्षमता कम हो जाती है और साथ ही शरीर में उत्पन्न दोषपूर्ण, अपसामान्य और हानिकारक कोशिकाओं की संख्या इतनी अधिक हो जाती है कि इससे ऊतकों की उत्तरोत्तर क्षति और नाश होता जाता है।

एक और सिद्धान्त के अनुसार काल प्रभावन या वृद्ध होने के कारण होने वाले प्राथमिक दोष केन्द्रीय तंत्रिका-तंत्र (सेन्ट्रल नर्वस सिस्टम) के कुछ केन्द्रों में प्रकट हो सकते हैं जो अंतः स्रावी ग्रंथियों (एन्डोक्राइन ग्लैन्ड्स) की क्रियाशीलता को उद्दीपित करते हैं। मस्तिष्क से उचित पथ प्रदर्शन के अभाव में ये ग्रंथियाँ ठीक से कार्य नहीं करतीं। हॉरमोनों की कमी से क्रियाशीलता दोषपूर्ण हो जाती है और कई ऊतकों तथा अंगों का काल प्रभावन शुरू हो जाता है। उदाहरण के लिए, मानव समेत कई प्राणियों में लैंगिक हॉरमोनों की कमी से काल प्रभावन के लक्षण उत्पन्न हो जाते हैं।

यद्यपि काल प्रभावन या वृद्ध होने के प्रत्येक सिद्धान्त के साथ कुछ प्रमाण भी हैं लेकिन कोई भी सिद्धान्त ऐसा नहीं है जिसने सभी जीवों की दृष्टि से इस परिघटना को समझाया हो। अतः सभी प्रकार के जीवों और कोशिकाओं में काल प्रभावन की व्याख्या करने वाला व्यापक सिद्धान्त तभी प्रतिपादित किया जा सकता है जब विभिन्न दशाओं में रहने वाली विभिन्न जातियों की काल प्रभावन की प्रक्रियाओं से सम्बन्धित अधिक से अधिक तथ्य हमारे सामने आएँ।

## अभ्यास

1. काल प्रभावन (एजिंग) और जीरोन्टोलॉजी की परिभाषा दो। मानव में काल प्रभावन के क्या लक्षण हैं?
2. काल प्रभावन की प्रक्रिया से सम्बन्धित कोशिकीय और कोशिकाबाह्य परिवर्तन कौन-कौन से हैं?
3. काल प्रभावन को समझाने के लिए प्रस्तुत किए गए विभिन्न सिद्धान्तों का वर्णन करो।
4. थाइमस ग्रंथि, केन्द्रीय तंत्रिका-तंत्र और हॉरमोन काल प्रभावन से किस प्रकार सम्बद्ध होते हैं?

# इकाई 3

# जीव विज्ञान और मानव कल्याण

## अध्याय-25

# मानव द्वारा पौधों का घरेलूकरण

मानव-सभ्यता के इतिहास में खेती करने की आरम्भिक अवस्थाएँ विभिन्न क्षेत्रों में मानव के बसने से सम्बद्ध मानी जाती हैं जो उसके खानाबदोश जीवन के बाद ही शुरू हुई। मानव समाज के विभिन्न वर्गों ने जहाँ बोआई शुरू की वे आरम्भिक स्थल मिस्र में नील नदी के इर्द-गिर्द के क्षेत्र, चीन की नदी वाली घाटियाँ और उत्तरी भारत के मैदान थे। ये उपजाऊ क्षेत्र थे और इनमें पानी इतनी बहुतायत से था कि वह फसल उगाने की सारी जरूरतों को पूरा कर सकता था। इन क्षेत्रों में अन्न के प्रचुर उत्पादन ने लोगों को आत्म-निर्भर बना दिया। इसी के परिणामस्वरूप वे सभ्यता के इतने ऊँचे शिखर पर पहुँच सके जिसके अवशेष अभी भी विद्यमान हैं।

भोजन के स्रोतों के रूप में जंगली पौधों से सम्बद्ध मानव का ज्ञान भले ही उसकी शिकार सम्बन्धी आदतों बराबर पुराना हो, लेकिन मानव सभ्यता के आरम्भिक संकेत सिन्धु घाटी (अब पाकिस्तान) में मिलते हैं जो गेहूँ, जौ तथा धान के आपसी सम्बन्धों की साफ तस्वीर प्रस्तुत करते हैं। इतिहासकार इन सभ्यताओं की आयु आज से करीब 5 से 6 हजार साल तक बतलाते हैं। इस बात की कल्पना आसानी से की जा सकती है कि मानव द्वारा अवश्य ही इतने हजार साल पहले कृषि कौशल का विकास किया गया होगा। मध्य एशिया क्षेत्र से निकली आर्य जनजातियाँ, जिन्होंने बाद में इस सभ्यता को प्रभावित किया, कृषि-कौशल—बैल और हल का उपयोग—जानती थीं और अपने पशुओं की व्यवस्था में भी सक्षम थीं। बाद में ये लोग संख्या और संस्कृति दोनों की दृष्टि से उत्तर भारत के मैदानों में और इससे भी और आगे सुदूर दक्षिण तक फैल गए।

इस तरह पूरे देश में विशेष प्रकार का कृषि-भूमि-समाज स्थापित हो गया। गाँव वाले उस भूमि में खेती करने लगे जो पहले राजाओं की थी फिर जमींदारों या अन्य भू स्वामियों की बनी, और लोग उन्हें राजस्व देने लगे जिससे राज्य और अधिकारियों का निर्वाह होता था। बाद में इसी तरह शासकों अथवा गाँव के प्रधानों को विविध सेवाओं के बदले में बढ़इयों, जुलाहों और सुनारों आदि के द्वारा भूमि के छोटे-मोटे लगान दिये जाने लगे। समाज में संपदा की हिस्सेदारी और श्रम-विभाजन की यह स्थापित प्रणाली बन गई, जो सल्तनतों तथा अन्य सामाजिक कारकों के आक्रमणों और परिवर्तनों के प्रति स्थायी साबित हुई।

लेकिन 1921 ई० के बाद आबादी की बढ़ती दर से खाद्य आपूर्ति की माँग उत्तरोत्तर बढ़ने लगी। सन् 1921 और 51 के बीच की अवधि में आबादी की औसत वार्षिक दर में करीब 1.3 से 1.4 प्रतिशत की वृद्धि और गेहूँ व धान सरीखे अन्नों की प्रति हेक्टेयर औसत उपज में कमी होती देखी गई। सन् 1901 में गेहूँ का उत्पादन औसत रूप से 798 कि० ग्रा० प्रति हेक्टेयर था जबकि सन् 1952 में केवल 645 कि० ग्रा०

प्रति हेक्टेयर। इसी तरह धान की उपज 1901 ई० में 1058 कि० ग्रा०/हेक्टेयर थी, जो 1952 ई० में केवल 800 कि० ग्रा०/हेक्टेयर ही रह गई।

भोजन के उपभोक्ताओं की संख्या और अन्न के उत्पादन के बीच की बढ़ती असमानताओं को कम करने के लिए हमारे देश में मिले जुले प्रयत्न आरम्भ किए गए। भले ही आबादी अभी भी अन्धाधुन्ध दर से बढ़ती जा रही है लेकिन पिछले कुछ वर्षों में अन्न की दृष्टि से देश आत्म निर्भर भी बना है।

सन् 1952 की गेंहूँ और धान की क्रमशः 645 कि० ग्रा० और 800 कि० ग्रा० वाली उपज की तुलना में 1971 ई० में गेंहूँ और धान की प्रति हेक्टेयर उपज क्रमशः 1195 कि० ग्रा० और 1074 कि०ग्रा० रही। गेंहूँ और धान के तत्सम्बन्धी वर्तमान आँकड़ों को क्रमशः करीब 1400 और 1800 कि० ग्रा०/हेक्टेयर वाली स्थिति में रखा जा सकता है। यद्यपि मौसम की गड़बड़ी के कारण सन् 1970 वाले दशक के आरम्भ से ही प्रति एकड़ उपज में कमी पायी गयी है फिर भी अन्न के उत्पादन में वृद्धि की बहुत आशा है। इसके लिए सिंचाई वाले कृषि-क्षेत्र में वृद्धि की गई है। फलस्वरूप गहन कृषि को बढ़ावा मिला है और इसी के कारण देश के कई भागों में "हरित-क्रांति" (ग्रीन रीवोल्यूशन) हो पाई। हरितक्रांति में इन बातों का महत्वपूर्ण योग रहा है—(i) फसलों की अधिक उपज वाली किस्मों का विकास और प्रवेश, (ii) देश के विशाल क्षेत्रों में अधिक उपज वाली किस्मों का प्रसार, (iii) पानी और उर्वरकों के अधिक प्रयोग से बहुशस्योत्पादन (मल्टिपल क्रॉपिंग), जिससे उसी खेत में एक साल में आर्थिक लाभ के लिए दो-तीन फसलें उगायी जा सकती है, (iv) रोग और पीड़कों (पेस्ट) के नियंत्रण के लिए फसल रक्षी उपायों का प्रयोग, और(v) अनुसंधान-फार्मों से उपलब्ध वैज्ञानिक कृषि और टैकनोलॉजी का गाँव के किसानों तक स्थानांतरण।

देश में विविध फसलों के सन्दर्भ में भविष्य के तुरंत, प्रयोग के लिए हरितक्रांति के आधार पर निम्नलिखित परियोजना है :

## सारणी 25.1

**क्षेत्र, उपज और उत्पादन की दृष्टि से सन् 1968-69 वर्ष के आँकड़ों को आधार मानकर सन् 1980-81 के वर्ष के लिए परियोजना के आँकड़े।**

| | 1968-69 | | | 1980-81 | | |
|---|---|---|---|---|---|---|
| | दस लाख हेक्टेयरों में क्षेत्र | उपज कि० ग्रा० प्रति हेक्टेयर | दस लाख टनों में उत्पादन | दस लाख हेक्टेयरों में क्षेत्र | उपज कि० ग्रा० प्रति हेक्टेयर में | दस लाख टनों में उत्पादन |
| अन्न | 99.2 | 843 | 83.6 | 107.00 | 1389 | 148.6 |
| दालें | 21.3 | 488 | 10.4 | 25.00 | 44 | 18.6 |
| तिलहन | 14.6 | 473 | 6.9 | 20.0 | 760 | 15.2 |
| गन्ना (गुड़ का तुल्यमान) | 2.5 | 4878 | 12.0 | 3.2 | 6875 | 22.0 |
| कपास (लिन्ट) | 7.7 | 124 | 0.85 | 11.5 | 172 | 1.98 |

हाल के कृषि सम्बन्धी अनुसंधान और जानकारी से गाँवों में पहले प्रचलित पारंपरिक विधियों में महत्वपूर्ण परिवर्तन आते जा रहे हैं। भूमि स्वामियों, काश्तकारों, कर्ज देने वाले साहूकारों और स्थानीय कारीगरों के बीच पारंपरिक सम्बन्ध से मुश्किल से ही कोई गाँव आत्म निर्भर इकाई का रूप ले पाता है। अपेक्षित सामग्री, जानकारी तथा कौशल और अन्य क्षेत्रों वाली उपज के आधार पर अब यह बाकी दुनिया से अधिक उन्नत रूप में सम्बद्ध होता जा रहा है। आवश्यक सामग्री तथा उत्पादन सम्बन्धी परिवहन के साथ-साथ अतिरिक्त अन्न आदि के भंडारण और वितरण से अच्छी सड़कों, गोदामों की मरम्मत की उत्तम सुविधाओं आदि की आवश्यकता अनुभव की जाने लगी है। गाँव के क्षेत्र का सारा नजारा ही बदल रहा है और मुद्रा बाजार की दृष्टि से किसान जो अलग-थलग पड़ जाता था वह परंपरा तोड़ दी गई है। ग्राम्य क्षेत्रों में भी राष्ट्रीयकृत बैंकों की शाखाएँ खुल गई हैं। किसान अब बड़े पैमाने पर बाहरी दुनिया से जुड़ता जा रहा है।

मानव द्वारा पौधों को घरेलू बनाने यानी खेती योग्य बनाने की कथा भारत में उस अवस्था पर पहुँच गई है कि सन् 1970 वाले दशक में ही हम राष्ट्रीय अर्थव्यवस्था में कृषि की प्रमुखता देखते हैं। हमारी आबादी के करीब तीन-चौथाई लोगों को इससे रोजगार मिलता है और राष्ट्रीय आय का आधा इसी से प्राप्त होता है। लेकिन कृषि सम्बन्धी हमारी हाल की सफलताएँ और उपलब्धियाँ भ्रम में डालने वाली बन जाएँगी यदि हम अभी से ही आत्म संतुष्ट हो जाएँगे। प्रत्येक वर्ष 15 लाख अतिरिक्त लोगों के लिए भोजन जुटाने के लिए राष्ट्रीय स्तर पर हमारे प्रयत्न अथक रूप से पूरे जोश-खरोश से चलते रहने चाहिए और निकट भविष्य के लिए इस कार्यक्रम की रूपरेखा निम्नलिखित प्रकार से चलनी चाहिए :

"1. अन्न की अधिक उपज वाली किस्मों का पूरी तरह से दोहन, जिसमें गुणात्मक पहलुओं पर विशेष रूप से ध्यान दिया जाना चाहिए।
2. प्रमुख *व्यापारिक* फसलों की पैदावार के स्तर को बढ़ाने के लिए चुने हुए क्षेत्रों में कृषि के गहन प्रयत्न।
3. सिंचाई की सुविधाओं का निरन्तर विस्तार और सिंचाई की वर्तमान विधियों में सुधार।
4. उर्वरकों, पादप रक्षी पदार्थों, फार्म-मशीनों और उधार सम्बन्धी आपूर्ति की व्यवस्था में विस्तार।
5. उत्पादनकर्त्ता के हक में कृषि विपणन प्रणाली (मार्केटिंग सिस्टम) में सुधार एवं प्रमुख कृषि-उपयोगी वस्तुओं के लिए निम्नतम कीमतों का आश्वासन।"*

लेकिन मानव की सुदूर भविष्य की भोजन सम्बन्धी आवश्यकताओं के लिए एक दूसरे आयाम को भी ध्यान में रखना होगा। अब तक ज्ञात पौधों की करीब साढ़े तीन लाख जातियों (स्पिसीज़) में से केवल कुछ जातियाँ ही भोजन स्रोतों के रूप में इस्तेमाल की जाती हैं और इनमें से केवल एकाध दर्जन जातियों से ही विश्व के खाद्य पदार्थों के 90 प्रतिशत अंश की आपूर्ति हो जाती है। इस सूची को लम्बी बनाने के लिए हमें अपनी खोज जारी रखनी होगी। विश्व के सूखे भागों को प्रयोग में लाने के लिए *कृषि सम्बन्धी अनुसंधानों की आवश्यकता* है, क्योंकि विश्व के वास योग्य क्षेत्र का करीब एक-तिहाई भाग सूखा क्षेत्र ही है। वर्तमान समय में इन क्षेत्रों में केवल लगभग 15 करोड़ लोग रहते हैं। यदि इन क्षेत्रों को हरे-भरे खेतों में बदल दिया जाय तो काफी लोगों का जीवन निर्वाह कराकर उनके रहन-सहन में सुधार लाया जा सकता है और इसकी सफलता तभी है जब विश्व के सभी देशों के सहयोग और मिले-जुले प्रयत्नों से जल-प्रबन्ध-टेक्नोलॉजी का समुचित विकास हो।

भूमि पर के सभी पौधों के मिले-जुले जैविक पदार्थ के उत्पादन की अपेक्षा समुद्र के पादप प्लवकों (फाइटो-प्लैंक्टन) के जैविक पदार्थ का उत्पादन कई गुना अधिक होता है। मानव केवल मछलियों और अन्य उन्हीं समुद्री प्राणियों का उपभोग करता है जो इन प्लवकों (प्लैंक्टन) का आहार करते हैं। अतः इस सन्दर्भ में उपयुक्त संसाधन टेक्नोलॉजी का विकास करके खाद्य पदार्थों की कहीं अधिक मात्रा उपलब्ध की जा सकती है। लेकिन वर्तमान समय में समुद्र दिन-ब-दिन अधिक संदूषित होते जा रहे हैं,

*एन० सी० ई० आर० टी०, नई दिल्ली के प्रकाशन 'अवर ऐग्रीकल्चर' (हमारी कृषि), से।

इसलिए इस प्रसंग में इच्छित जानकारी प्राप्त करने के लिए मिले-जुले रूप में तत्सम्बन्धी अनुसंधान और कार्यक्रम की रूपरेखा बनाना आवश्यक है।

अपनी दिनों-दिन बढ़ती जाने वाली आवश्यकताओं की पूर्ति के निमित्त पौधों को खेती योग्य या घरेलू बनाने की इस परियोजना में मानव को अभी बहुत मंजिलें तय करनी हैं। लेकिन यह निश्चित है कि इस क्षेत्र में अभी बहुत अधिक संभावनाएँ हैं।

## अभ्यास

1. समझाओ कि पौधों का पालतूकरण या घरेलूकरण विभिन्न सभ्यताओं के आरम्भिक विकास से किस प्रकार सम्बन्धित है ?
2. हमारे वर्तमान कृषि-समुदाय पिछली शताब्दी के कृषि-समुदायों से किस प्रकार भिन्न हैं ?
3. वर्तमान सदी के आरम्भ से आबादी की वृद्धि की दृष्टि से खाद्य उत्पादन के महत्वपूर्ण परिवर्तनों का वर्णन करो।
4. भारत में "हरितक्रांति" के विविध घटकों का उल्लेख करो।
5. मानव की भोजन सम्बन्धी लघुकालीन और दीर्घकालीन आवश्यकताओं की पूर्ति के लिए प्रस्तावित योजना का मूल्यांकन करो।

# अध्याय-26

# खेती की महत्वपूर्ण फसलें

हमारे देश में 70% से अधिक कृषि-क्षेत्र उन अन्नों के अंतर्गत है जिनमें धान्य, ज्वार-बाजरा और दालें आती हैं।

ये धान्य (गेहूँ, चावल आदि) पौधों के एक ही 'कुल' ग्रैमिनी के अंतर्गत है, और यही 'कुल' मानव को मुख्य रूप से भोजन प्रदान करता है। धान्य या अनाज का दाना फल ही है, जिसमें अंडाशय की सूखी भित्ति (दीवार) उसके अन्दर के एक मात्र बीज के आवरण से जुड़ जाती है। दानों में जमा पदार्थों में मुख्यतया कार्बोहाइड्रेट (प्रमुख रूप से माँड़ या स्टार्च), कुछ प्रोटीन, और अल्प मात्रा में लिपिड, विटामिन और खनिज होते है।

धान्य एकवर्षी शाक हैं, जिनमें बेलनाकार तना होता है। पोरियाँ (इन्टरनोड) अधिकांशतया खोखली लेकिन उनको जोड़ने वाली गाँठें (नोड) ठोस होती हैं। अन्य वानस्पतिक लक्षणों के अलावा (देखो भाग I) इनका प्ररूपी पुष्पक्रम (इनफ्लोरेसेन्स) यानी स्पाइकलेट इनकी विशेषता है जिसमें वृंतहीन या डंठलहीन फूल होते हैं। धान्यों के पुष्पक्रम को आम भाषा में 'बाल' (इयर) कहा जाता है, जिसके आने से शीर्ष वृद्धि (एपिकल ग्रोथ) समाप्त हो जाती है।

सिंचाई, खाद, जुताई सरीखे कृषि-पहलुओं; चयन, संकरण (हाइब्रिडाइजेशन), उत्परिवर्तन (म्यूटेशन) सरीखे सुधार सम्बन्धी पहलुओं; पोषक पदार्थों सम्बन्धी आवश्यकताओं, प्रकाश-संवेदिता, प्रकाशसंश्लेषी दक्षता सरीखे शरीरक्रियात्मक पहलुओं; तथा उपज का निर्धारण करने वाले कारकों और रोगों व पीड़कों के पहलुओं से धान्यों पर बहुत खोजें की गई हैं।

## धान्य

धान और गेहूँ के, जो कि विश्व के सबसे महत्वपूर्ण धान्य हैं, शस्यविज्ञानीय (ऐग्रोनोमिक) पहलुओं को नीचे प्रस्तुत किया जा रहा है।

### धान (चावल)

भारत में सभी धान्यों में, धान (**ओरिज़ा सैटाइवा**) सबसे अधिक क्षेत्रफल यानी 3.967 करोड़ हेक्टेयर में लगाया जाता है। इसका वर्तमान वार्षिक उत्पादन 7.5 करोड़ टन है। देश की आबादी के आधे से अधिक लोग मुख्य भोजन के रूप में धान का उपयोग करते हैं। यह एशिया महाद्वीप का सबसे लोकप्रिय भोजन है। एशिया की पानी और नमी वाली जलवायु इस फसल के लिए बहुत ही उपयुक्त है। अब तो सिंचाई की सुविधाओं के प्रसार से पंजाब के मैदानी क्षेत्रों में भी धान की काफी खेती होने लगी है।

यद्यपि देश के करीब सभी भागों में धान लगाया जाता है तो भी उत्तर प्रदेश, बिहार, पश्चिमी बंगाल और असम राज्यों में भारत के कुल धान-क्षेत्र का करीब तीन-चौथाई धान लगाया जाता है। देश के सभी भागों में अधिक उपज वाली नई किस्में (वैराइटीज) प्रविष्ट की गई

हैं, जैसे कि कावेरी, टी-141, पद्मा, जया, पंकज, साबरमती, आई आर-8, और जगन्नाथ। इनमें से कुछ लघु अवधि वाली बौनी किस्में हैं, जिनकी उपज क्षमता बहुत अधिक है। इनमें सुचारु रूप से सिंचाई व खाद की व्यवस्था से धान के वार्षिक उत्पादन को और अधिक बढ़ाया जा सकता है।

यद्यपि धान को विभिन्न प्रकार की भूमि में उगाया जा सकता है तो भी इसके लिए सबसे उपयुक्त भूमि मृत्तिका-दुमट है और सबसे अनुपयुक्त भूमि बड़े कणों वाली मिट्टी होती है। पौधों के जीवन-इतिहास के अधिकांश भाग में भूमि को जलमग्न अवस्था में रखा जाता है। इस प्रकार धान एक अर्धजलीय पौधा है।

धान की खेती का मौसम भी विचित्र प्रकार का होता है क्योंकि इसे गर्मी या वर्षा ऋतु की फसल के रूप मे बोया जाता है। उत्तरवर्ती मैदानों में एक प्रकार की खेती में जाड़े की ऋतु के मध्य तक कहीं जाकर फसल पक पाती है। इसलिए आज का चलन यह है कि भिन्न-भिन्न ऋतुओं और भिन्न-भिन्न किस्मों की सिफारिश की जाती है। बीजों को या तो सीधे ही छिड़क दिया जाता है या नवोद्भिदों (सीडलिंग) के रूप में उगाकर फिर उन्हें जलमग्न खेतों में रोप दिया जाता है। खेत की अच्छी तरह से तैयारी का मतलब है हल चलाकर खूब जुताई करना।

धान की गहन कृषि में इसके अलावा उर्वरकों और खाद की अधिक मात्रा डाली जाती है और साथ ही रोगों और पीड़कों के संक्रमण से फसल को मुक्त रखने के लिए पादप रक्षण के उपयुक्त उपाय भी अपनाए जाते है।

यद्यपि बोआई और फसल की कटाई हाथ से ही की जाती है लेकिन दांवने या थ्रेशिंग के लिए अब मशीनों का अधिक से अधिक उपयोग किया जा रहा है।

## गेहूँ

देश में क्षेत्र और उत्पादन की दृष्टि से धान के बाद गेहूँ (**ट्रिटिकम वल्गेर**) का ही नंबर आता है। इसकी खेती 2.01 करोड़ हेक्टेयर में की जाती है और उत्पादन 2.83 करोड़ टन होता है। भारत में एक दशक की अवधि में गेहूँ का उत्पादन करीब चार गुना बढ़ गया है। गेहूँ के मुख्य उत्पादक राज्य हैं—उत्तर प्रदेश, पंजाब, राजस्थान, मध्यप्रदेश और हरियाणा। इनके अतिरिक्त बिहार, कर्नाटक, महाराष्ट्र आदि राज्य भी काफी मात्रा में गेहूँ का उत्पादन करते हैं। गेहूँ-क्रांति, हरित क्रांति का प्रमुख अंग है। वह रोगरोधी, उर्वरक के प्रति अनुकूल प्रतिक्रिया दिखलाने वाली, मजबूत तने वाली, तथा बौनी किस्मों को प्रविष्ट करने से ही सफल हो पायी। इनके जनक या मूल प्रभव (स्टॉक) को मैक्सिको से आयातित किया गया था।

अपने देश में भारतीय जलवायु और अभिरुचि के अनुकूल किस्मों को उत्परिवर्तन और संकरण के माध्यम से विकसित किया गया है। देश के अन्य प्रदेशों में गहन कृषि की नई तकनीकों से गेहूँ की पूर्ण क्रांति की जा सकती है। इसमें सिंचाई वाले क्षेत्र की कमी एक प्रमुख व्यवरोध है।

गेहूँ की कई नई किस्में हैं, जिनमें कुछ ये हैं—कल्याण सोना, सोनालिका, शरबती, सोनोरा, हीरा, यूपी 301, आर-आर- 21, यूपी 308 और मोती।

गेहूँ सिंचित और असिंचित दोनों क्षेत्रों में उगाया जाता है लेकिन असिंचित क्षेत्र में इसकी औसत उपज काफी कम होती है। रबी की फसल के रूप में, उत्तरी मैदानों में इसको उगाने वाला मुख्य मौसम अक्टूबर से मार्च तक है। पकने में यह लगभग 4-5 महीने लेता है इसलिए इसकी खेती वर्षा ऋतु और गर्मी की ऋतु के बीच में सीमित करके कम कर दी जाती है। असिंचित दशाओं में, जाड़े में एक या दो फुहारों से उपज में काफी अन्तर पड़ जाता है। यदि सिंचाई की सुविधाएँ उपलब्ध हों तो अधिकतम उपज के लिए तीन सिंचाई आदर्श होती है। देशी किस्मों की तुलना में नई अधिक उपज वाली बौनी किस्मों को अधिक उर्वरकों और पानी की जरूरत होती है।

## ज्वार-बाजरा आदि (मिलेट्स)

ज्वार (**सौर्गम वल्गेर**), बाजरा या पर्ल मिलेट (**पेन्नीसीटम टाईफाइड्स**) और रागी या फिंगर मिलेट (**एल्यूसाइन कोरकाना**) ही प्रमुख भारतीय मिलेट्स हैं। इनमें ज्वार का प्रथम स्थान है, जिसकी खेती 1.6 करोड़ हेक्टेयर में होती है और जिसकी वार्षिक

उपज 95 लाख टन है। बाजरा या पर्ल मिलेट की खेती 1.16 करोड़ हेक्टेयर क्षेत्र में होती है, और इसका वार्षिक उत्पादन 58 लाख टन है। रागी या फिंगर मिलेट की खेती 1977 में 26 लाख हेक्टेयर में होती थी और उत्पादन 26 लाख टन था। अकेले कर्नाटक राज्य ने ही इसकी खेती से कुल उपज का 30 प्रतिशत उत्पन्न किया और शेष उत्पादन तमिलनाडु, महाराष्ट्र, आंध्रप्रदेश, बिहार और उत्तर प्रदेश से हुआ। बाजरा अपने देश के सूखे भागों की फसल है जो अधिकांशतया राजस्थान, गुजरात, महाराष्ट्र, हरियाणा और उत्तर प्रदेश में उगायी जाती है। एच बी 1, एच बी 3 और एच बी 4 हाल की कुछ अधिक उपज वाली किस्में हैं। ज्वार भी देश के सूखे भागों की महत्वपूर्ण फसल है और इसका अधिकांश असिंचित दशाओं में ही उगाया जाता है। सी एच एस 1, सी एच एस 2 और स्वर्ण कुछ अधिक उपज वाली संकर (हाइब्रिड) किस्में हैं।

ज्वार-बाजरा आदि को मानव भोजन तथा पशुओं के भोजन या चारे के रूप में इस्तेमाल किया जाता है। खाए जाने वाले अन्न के रूप में शहर के लोगों में ये लोकप्रिय नहीं हैं और गाँवों में भी गेहूँ और धान के बाद ही इन्हें चाहा जाता है। रागी को शिशु आहार के रूप में संसाधित किया जाता है क्योंकि इसमें बहुत पोषक तत्वों वाले गुण पाए गए है।

## दालें

*हमारे आहार में दालें प्रोटीन स्रोत के रूप में* महत्वपूर्ण हैं। ये शिबी या सेम कुल की (लेग्युमिनस) फसलें है जो असिंचित भूमि में उगाई जाती हैं। ये धान्य की दो फसलों के बीच में भी बोई जाती है क्योंकि दालों के पौधों की जड़ों में ऐसी ग्रंथिकाएँ या गाँठें (नोड्यूल) होती हैं जो वायु की नाइट्रोजन को स्थिर करके भूमि को उर्वर बना देती हैं, इसी कारण प्रायः इनमें खाद नहीं डाली जाती। अरहर (**कैजेनस कैजन**), चना या बंगाली ग्राम (**साइसर ऐरीटिनम**), उड़द या ब्लैक ग्राम (**फेसिओलस मंगो**), मूँग या ग्रीन ग्राम (**फेसिओलस आरियस**), मसूर या लेंटिल (**लेन्स एस्कुलेन्टा**) हमारे भोजन की महत्वपूर्ण दालें हैं। हाल में सोयाबीन (**ग्लिसाइन मैक्स**) की खेती पर काफी जोर दिया गया है क्योंकि इससे उच्च गुणवत्ता वाला प्रोटीन और तेल प्राप्त होता है।

### चना

भारत की दालों मे चना बहुत महत्वपूर्ण है। यूँ तो *यह सारे ही देश में बोया जाता है लेकिन इसकी खेती* का 30 प्रतिशत क्षेत्र उत्तरी भाग में ही है। इसकी फसल के लिए कपास वाली काली भूमि (प्रचुर चिकनी मिट्टी वाली) बहुत अधिक उपयुक्त होती है। कभी-कभी यह मृत्तिका-दुमट या चिकनी मिट्टी वाली दुमट में उगाया जाता है लेकिन कभी भी अन्य किसी प्रकार की भूमि में नहीं। रबी की फसल के रूप में इसे अक्टूबर से दिसम्बर के दौरान बोया जाता है (वर्षा ऋतु के बाद) और भूमि में जो नमी जमा रहती है उसका यह फसल पूरा उपयोग करती है। *यद्यपि इसे बहुधा सूखी दशाओं में ही उगाया* जाता है लेकिन थोड़ी बहुत सिंचाई से फसल की पैदावार में काफी बढ़ोतरी हो जाती है। इसकी उपज 600 कि० ग्रा०/हेक्टेयर से 1600 कि० ग्रा०/हेक्टेयर तक होती है।

चने के पौधे छोटे (30 सेंमी०—50 सेंमी० ऊँचे) होते हैं जो बहुत शाखित होते हैं। पत्तियाँ नीले-हरे रंग की और पिच्छाकार (पिन्नेट) प्रकार की संयुक्त (कम्पाउण्ड) पत्तियाँ होती हैं।

फूल एकल और पत्तियों की कक्षों (ऐक्सिल) में होते हैं (विस्तृत जानकारी के लिए देखो लेग्युमिनोसी कुल, भाग 1)।

बीज के लक्षणों के आधार पर सुस्पष्ट रूप से इसकी कई किस्में हैं और यह पकने पर पीला, हरा, काला या भूरा हो सकता है। बीजों को तलकर या उबालकर खाया जाता है। इन्हें पीसकर आटा या बेसन बनाया जाता है, और देश के विभिन्न भागों में अलग-अलग तरह से मीठे या नमकीन पकवान बनाए जाते हैं। घोड़े के चारे के रूप में भी इसे इस्तेमाल किया जाता है।

## तिलहन (ऑयल सीड)

हमारे देश में तिलहन की खेती कुल कृषि क्षेत्र के करीब 10 प्रतिशत क्षेत्र में होती है, लेकिन इसका बहुत कम अंश सिंचाई वाला होता है। तिलहन की फसलें

प्राय: अन्य फसलों के साथ मिलाकर बोई जाती हैं। देश में हमारी वार्षिक आवश्यकताओं की दृष्टि से तिलहनों का उत्पादन कम पड़ता है।

सैफोला (कार्थेमस टिंक्टिओरिअस), बिनोला (गोसिपियम हर्बेसियम), मूँगफली (ऐरेकिस हाइपोजिया), तिल (सीसेमम इण्डिकम), नारियल (कोकोस न्यूसिफेरा) तथा हाल में प्रचलित सूरजमुखी (हेलिएन्थस ऐनुअस) और ब्रैसिका कुल की (ब्रैसिका कैम्पेस्ट्रिस) अन्य फसलें तिलहनों की महत्वपूर्ण फसलें हैं, जो भारत में मानव उपभोग के लिए तेल प्राप्त करने के लिए इस्तेमाल की जाती हैं।

### मूँगफली (ग्राउण्डनट)

वैसे तो यह मुख्य रूप से उष्णकटियधीय फसल है लेकिन इसकी खेती उपोष्ण भागों यहाँ तक कि दुनिया के ठंडे भागों में भी होती है, जहाँ इसके पकने के लिए लम्बी ग्रीष्म ऋतु होती है। भारत में इसकी खेती सभी स्थानों पर होती है, लेकिन तमिलनाडु और महाराष्ट्र इसके महत्वपूर्ण केन्द्र हैं।

इसे सूखी और सिंचित दोनों प्रकार की फसलों के रूप में बोया जाता है, लेकिन 50 सेंमी० से कम वर्षा वाले क्षेत्रों में और बिना सिंचाई के इसकी उपज कम होती है। इसके लिए कुछ बलुई मिट्टी या बलुई-दुमट वाली भूमि उपयुक्त होती है लेकिन अब यह सभी किस्म की भूमि में उगाई जाने लगी है। जल्दी पकने वाली कई किस्मों की खेती हो रही है जो 3 महीने से भी कम समय में तैयार हो जाती है। यह पौधा पैपिलिओनेसी उपकुल के अन्तर्गत है, जो अधिक शाखाओं और भूशायी स्वभाव वाला एक वर्षी (हर्ब) है। इसके फूल (देखो लेग्युमिनोसी कुल, भाग 1 फूल सम्बन्धी विस्तृत जानकारी के लिए) डंठलों पर उपरिभूस्तारी तने (रनिंग स्टेम) के निकट लगे रहते है, जो निषेचन के बाद नीचे मुड़कर भूमि में वहाँ प्रवेश करते हैं जहाँ फली वृद्धि करती और परिपक्व होती है। पकनेपर समूचा पौधा बाहर खींचा जाता है और फलियाँ पृथक कर ली जाती हैं। किस्म और संवर्धन सम्बन्धी दशाओं के अनुसार बिना भूसे वाली फलियों की उपज 800 किग्रा०/हेक्टेयर और 2000 किग्रा०/हेक्टेयर के बीच होती है।

## रेशे वाली फसलें (फाइबर क्रॉप्स)

कपास और जूट दो सर्वाधिक महत्वपूर्ण रेशे वाली फसलें हैं जो हमारे वस्त्र और जूट उद्योग के लिए कच्चा माल प्रदान करती हैं। अधिकांशतया इन्हें असिंचित दशाओं में उगाया जाता है। हमारी अधिकांश कपास अपनी गुणवत्ता के कारण मोटे कपड़ों के उपयुक्त ही होती है। बढ़िया कपड़ों के लिए लम्बे रेशे वाली कपास का हम अन्य देशों से आयात करते हैं। अपनी कुछ लम्बे रेशे वाली विकसित किस्में सुजाता और हाइब्रिड नं० 4 हैं। कपास देश के मध्य भागों में उगाई जाती है तो जूट असम, पश्चिमी बंगाल तथा बिहार के पूर्वी राज्यों में। भारत में अधिक उपज वाली और उर्वरकों के प्रति अनुकूल अनुक्रिया दिखलाने वाली किस्मों के विकास के लिए गहन अनुसंधान चल रहे हैं।

## सब्जी की फसलें

हमारे आहार मे खनिजों और विटामिनों के मुख्य स्रोत सब्जियाँ हैं लेकिन दुनिया के अन्य देशों की अपेक्षा हमारे यहाँ इनकी प्रति व्यक्ति खपत बहुत कम है। खनिज और विटामिन प्रदान करने के अतिरिक्त ये हमें प्रोटीन और कार्बोहाइड्रेट भी देती हैं।

देश के सभी भागों में घरों के इर्द-गिर्द की बगीची वाड़ियों (किचन गार्डन) में विभिन्न प्रकार की सब्जियाँ उगायी जाती हैं, जैसे कि — फूलगोभी, टमाटर, बैंगन, हरी मटर, पत्ता गोभी, शलजम, सलाद (लेट्यूस), हरी सेम, भिंडी, गाजर, प्याज, पालक, क्यूकरबिटेसी कुल की लौकी, कद्दू आदि अनेक सब्जियाँ। इसके अतिरिक्त खेत वाली अन्य फसलों की तरह बड़े प्लाटों में भी इन्हें उगाया जाता है।

सब्जियाँ पौधों के कई अलग-अलग कुलों में आती हैं, जो अपने स्वभाव, खेती के तरीके, मौसम, खाए जाने वाले भागों और नष्ट हो जाने की दृष्टि से आपस में बहुत भिन्न होती हैं। यद्यपि इन सब बातों का वर्णन इस समय यहाँ नहीं किया जा सकता लेकिन फिर भी अधिकांश सब्जियों के बारे में एक सामान्य बात यह है कि अन्न की अन्य फसलों की तुलना में इनमें प्रति पौधा अधिक देखभाल की जरूरत पड़ती है।

## फलों की फसलें

सब्जियों की तरह ताजे फलों से भी अपने आहार में विटामिन और खनिज प्राप्त होते हैं लेकिन पत्तीदार या हरी सब्जियों के विपरीत केला, अंगूर, आम सरीखे कई फल अधिक मात्रा वाली शर्करा के स्रोत हैं, इसलिए ये ऐसे भोजन हैं जो अधिक ऊर्जा (एनर्जी) प्रदान करते है।

फलों की फसलों के अन्तर्गत चिरस्थायी वृक्ष हैं, जैसे उष्णकटिबंधी तथा उपोष्णकटिबंधी भागों के आम, अमरूद, पपीता, संतरा आदि, और ठंडे भागों के सेब, खुबानी, आड़ू, प्लम या आलूबुखारा, अंगूर आदि फल। सब्जियों की तरह ये फल वाले पेड़ भी घरों के चारों ओर तथा सड़कों के किनारे कतारों में या बड़े व्यापारिक स्तर पर बगीचों में उगाए जाते हैं। मौसम के बाद फलों व उनके उत्पादों को संसाधित और परिरक्षित करने के कई तरीके हैं, जैसे कि रस निकालकर, डब्बाबन्दी करके, अचार डालकर तथा सुखाकर, जो देश के विभिन्न भागों में खूब प्रचलित हैं।

### आम

आम (**मैंगीफेरा इन्डिका**) दुनिया के कई भागों के उष्ण-कटिबंधी और उपोष्णकटिबंधी क्षेत्रों में फलों की एक बहुत लोकप्रिय फसल है। इसके फल गुच्छों में लगते हैं जो किस्म और स्थान विशेष के अनुसार पकने पर विविध प्रकार के रंग, गूदा, स्वाद और सुवास अपना लेते हैं। द्विवर्षी या दोसाला होना आम की सामान्य परिघटना है। इसका अर्थ यह हुआ कि पेड़ की प्रत्येक टहनी में फूलों के शीर्ष गुच्छे दो साल में केवल एक बार ही उत्पन्न होते हैं। प्रति वर्ष प्रत्येक टहनी की कायिक वृद्धि अपनी जनन-वृद्धि के साथ एकांतरण (आल्टर्नेशन) करती है। लेकिन यह जरूरी नहीं कि हर साल सभी शाखाओं या टहनियों की कायिक अथवा जनन-वृद्धि में तुल्यकालिकता (सिनक्रोनाइजेशन) हो। आम में किस्म के सुधार और प्रचारण (प्रोपगेशन) के लिए तने में कलमें लगाना बहुत पुरानी और सामान्य विधि है।

### केला

केला (म्यूजा सैपाइन्टम) एक सस्ता फल है जो एकबीजी पत्तियों (मोनोकोटीलेडनस) के म्यूजेसी कुल में आता है। उष्णकटिबंधी प्रदेशों का यह लोकप्रिय फल है और शीतोष्ण प्रदेशों में मुश्किल से ही उगता है। पौधों की विशेषता यह है कि इनमें भूमि के ऊपर मुलायम व बेलनाकार काय या तना होता है, जिसमें शीर्ष (सिरे) पर पत्तियों को धारण किए रहने वाली पर्णच्छद (लीफ शीथ) होती है। पुष्पक्रम (इनफ्लोरेसेन्स) शीर्ष पर गुच्छे के केन्द्र से निकलता है जिनमें फूल बड़े सहपत्रों (ब्रैक्ट) के कक्षों से उत्पन्न होते हैं। फल सामान्यतया अनिषेकफलन (पार्थनोकार्पी) की रीति से उत्पन्न होते हैं और पकने पर इनकी त्वचा किस्मों के अनुसार पीली, हरी अथवा लाल होती है। प्रचारण वर्धी (वेजीटेटिव) प्रकार का होता है जिसमें भूमिगत (अन्डरग्राउन्ड) तने वाले तरुण पौधों का प्रतिरोपण किया जाता है।

## गन्ना

*गन्ना* (***सैक्केरम आफिसिनेरम***) घासों के कुल के अंतर्गत है और यह अपने देश की सारी शर्करा का स्रोत है। भारत को इस फसल का मूल स्थान माना जाता है, *जहाँ से यह दुनिया के सभी भागों में फैल गया।* मुख्यतया तो यह उष्णकटिबंधी या उपोष्णकटिबंधी फसल है लेकिन कभी-कभी इसकी खेती शीतोष्ण भागों तक भी फैल जाती है। *भारत में यह 20 लाख हेक्टेयर भूमि से अधिक क्षेत्र में* बोया जाता है और यहाँ का कुल उत्पादन दुनिया के किसी भी एक गन्ना उत्पादक देश के उत्पादन से अधिक है। गन्ने का वृद्धि काल 10 महीने से 18 महीने तक चलता है लेकिन भारत में यह वार्षिक फसल के रूप में बोया जाता है जिसकी फसल उत्तरी भागों में जाड़े में काटी जाती है। पाले से इसको बड़ी जल्दी हानि पहुँचती है। गन्ने की खेती की सबसे अच्छी यानी आदर्श जलवायु अपने देश के दक्षिणी भागों में पायी जाती है लेकिन पंजाब, हरियाणा, उत्तरप्रदेश, बिहार और उड़ीसा आदि उत्तरी राज्यों में इसे बहुतायत से बोया जाता है। इसका प्रचारण वर्धी या कायिक भागों से होता है। कक्षीय

(ऐक्सिलरी) कलिकाओं (कलियों) वाले तने के कटे भागों को एक कतार में रोप कर फसल उगाई जाती है। यद्यपि सिंचाई से पैदावार में बहुत सुधार होता है लेकिन गन्ने की खेती अधिकांशतया अभी भी वर्षापोषित दशाओं में की जाती है। शर्करा की उपज तने के ताजा भार के 8 से 10% तक होती है।

## अभ्यास

1. अपने देश में उगाए जाने वाले धान्यों का संक्षेप में वर्णन करो।
2. भारतीय मिलेट यानी ज्वार-बाजरा आदि में महत्वपूर्ण कौन है और उन्हें किन दशाओं में बोया जाता है ?
3. भारत में दालों को कैसे उगाया जाता है ? दाल की फसलों के लिए नाइट्रोजनीय उर्वरकों (फर्टिलाइजर्स) की आपूर्ति की अधिक जरूरत क्यों नहीं पड़ती ?
4. आमला और केले में प्रचारण की रीति संक्षेप में बताओ।
5. कुछ महत्वपूर्ण तिलहनों के नाम बताओ और मूँगफली की खेती का संक्षेप में वर्णन करो।
6. धान (चावल), गेहूँ, ज्वार, बाजरा और कपास की कुछ उन्नत या सुधरी किस्मों के नाम बताओ।

# अध्याय-27

# पौधों के रोग

पौधों के रोगों की जानकारी इतिहास के आदि काल से ही है। बाइबिल तथा यूनानियों व रोमनों की प्राचीन पुस्तकों में अंगमारी (ब्लाइट), आसिता (मिलड्यू) और किट्ट (रस्ट) का उल्लेख तो मिलता है लेकिन इनके कारण के बारे में किसी को पता नहीं था। प्राचीन रोमवासी रोबिगेस और रोबिगो नामक दो देवताओं का धान्यों के किट्ट रोग से सम्बन्ध मानते थे और इसीलिए इन देवताओं को सन्तुष्ट रखने के लिए वे *रोबिगेलिया* नामक वार्षिक त्यौहार मनाते थे। संक्रमित खेतों में पशुओं के चरने के कारण होने वाला अर्गट रोग (एर्गोटिज्म) का कारण वहाँ पर व्याप्त बुरी आत्माएँ समझी जाती थीं। इस प्रकार से फैले अंधविश्वासों को दूर करने और गलत सिद्ध करने में वैज्ञानिकों को बहुत अधिक समय लगा।

मानव को यह तो मालूम था कि कई बीमारियाँ संसर्गज (कन्टैजियस) या संक्रामक होती है पर उनका कारण तब तक ज्ञात न हो सका जब तक कि ल्यूवेनहॉक ने सन् 1676 में अपने साधारण अपरिष्कृत सूक्ष्मदर्शी (माइक्रोस्कोप) की खोज करके कोरी आँख से न देखी जा सकने वाली सूक्ष्मजीवों की अदृश्य दुनिया को आँखों के सामने उजागर नहीं कर दिया। ल्यूवेनहॉक वस्त्रों का व्यापारी था और लेन्सों को घिसना उसका शौक या हॉबी थी। उसने "नन्हें सूक्ष्म प्राणियों" (बक्टीरिया, यीस्ट) की खोज की सूचना लन्दन की रॉयल सोसाइटी को दी और इसीलिए उसे आज सूक्ष्मजीवविज्ञान (माइक्रोबायोलॉजी) का जनक कहा जाता है। यद्यपि सूक्ष्मजीवों की खोज सत्रहवी शताब्दी में हुई, तो भी इस बात के स्पष्ट प्रमाण लगभग 200 साल बाद मिले कि रोग विभिन्न सूक्ष्मजीवों द्वारा ही उत्पन्न होते हैं। खास बात यह भी रही कि ये प्रमाण मानव या प्राणि रोगों से प्राप्त नहीं हुए बल्कि पौधों के रोगों के अध्ययन से प्राप्त हुए। इतालवी वनस्पति विज्ञानी मिशेली ने कवकों के बीजाणुओं (स्पोर) के अंकुरण का निरीक्षण किया, फ्रांसीसी कवकविज्ञानी (माइकोलाजिस्ट) टिले (1755) ने गेहूँ के बंट रोग की खोज की, और प्रीवोस्ट (1807) ने कवक और उसके परपोषी (होस्ट) गेहूँ के पौधे में गहरा सम्बन्ध देखा। प्रीवोस्ट ने विशेष रूप से बीजाणुओं के अंकुरण का निरीक्षण करते हुए गेहूँ के तरुण पौधे के अंदर कवक के तंतुओं (हाइफा) को प्रविष्ट होते देखा। लेकिन इन प्रेक्षणों में से किसी पर भी लोगों ने ध्यान नहीं दिया।

सन् 1845 में सारे उत्तरी यूरोप में आलू के पौधों को आलुओं का अंगमारी (पोटेटो ब्लाइट) नामक बीमारी से भारी नुकसान पहुँचा और रातों रात आलुओं के सारे खेत सड़े-गले पौधों के काले ढेर भर रह गए। इसका सबसे अधिक असर आयरलैंड पर पड़ा जिसका प्रमुख आहार आलू ही है। इसके बाद के दो सालों में करीब पाँच

लाख आयरलैंडवासियों की मृत्यु हुई और इतिहास में इस अकाल को आयरलैंड का आलू वाला महाअकाल कहा गया । लेकिन इस अकाल को अप्रत्यक्ष कृपादान कहा जा सकता है क्योंकि इसके कारण लोगों ने जल्दी ही पादप रोगों के महत्व को समझना शुरू कर दिया। भाग्य से इस बीच अच्छे-अच्छे सूक्ष्मदर्शी (माइक्रोस्कोप) उपलब्ध होने लगे और निरीक्षण करके पाया गया कि नष्ट होने वाले आलू के पौधे कवकजाल (माइसीलियम) से भरे पड़े थे। यह कवकजाल रोग का कारण था या रोग का परिणाम, इस सम्बन्ध में फिर विवाद शुरू हुआ, जिसका समाधान किया ब्रिटिश कवकविज्ञानी एम०जे० बर्कले और जर्मन कवकविज्ञानी हेनरिख एन्टन डी बैरी ने। सन् 1861 में उन्होंने इस कवक (फंगस) को **फ़ाइटोफ्थोरा इनफेस्टेन्स** के नाम से पहचाना और इस बात के संतुष्टकारी प्रमाण दिए कि यह कवक आलू के अंगमारी रोग (ब्लाइट) का कारण था न कि रोग का परिणाम। इससे इस बात की स्थापना हो गई कि कवकों से पौधों के रोग होते हैं और इस प्रकार विज्ञान की एक पृथक शाखा यानी पादप रोग विज्ञान (प्लान्ट पैथॉलाजी) का जन्म हो गया।

सन् 1876-78 के दौरान फ्रांसीसी रसायन विज्ञानी लुई पास्तेर, जर्मनी के तरुण डाक्टर राबर्ट कॉख और ब्रिटिश सर्जन जोसेफ लिस्टर ने सब सन्देहों को दूर करके सिद्ध करके दिखाया कि रोगों के कारण जर्म या रोगाणु हैं। कॉख के प्रयोगों के आधार पर 'कॉख अभिगृहीत' (कॉख पोस्टुलेट) प्रस्तुत किए गए जो आज भी माने जाते हैं क्योंकि इन्हीं के आधार पर मानव, प्राणी या पौधे में होने वाले विशिष्ट रोग और विशिष्ट सूक्ष्मजीव के बीच कारणात्मक सम्बन्ध स्थापित किया जाता है।

पादप रोग क्या है? किसी 'रोगी' पौधे को हम स्वस्थ पौधे से कैसे अलग पहचानते हैं? किसी पौधे को तभी स्वस्थ माना जाता है जब कि सारी शरीरक्रियात्मक प्रक्रियाएँ उसके सभी अंगों और भागों के समन्वित क्रिया-कलापों के अनुसार चलती हैं।

शरीर क्रियात्मक (फ़िजियोलॉजिकल) प्रक्रिया में गड़बड़ी पहुँचाने पर पौधा रोगी हो जाता है और उसके आकारिक परिवर्तनों में यह प्रकट हो जाता है। इस तरह रोग के कारण कुछ 'लक्षण' (सिम्पटम) उत्पन्न होते हैं। पौधे की रोगी अवस्था पर भौतिक या बाहरी वातावरण का बहुत अधिक प्रभाव पड़ता है, जैसे कि भूमि की दशा, नमी, तापमान और अन्य कारकों का। लेकिन इसके विपरीत स्वस्थ पौधा अपने और वातावरण के बीच संतुलन बनाए रखता है।

सन् 1870 के इर्दगिर्द अंगूरों के चूर्णी आसिता रोग (डाउनी मिल्ड्यू) ने अंगूर के उद्यानों को क्षति पहुँचाकर एक आशंका उत्पन्न कर दी और फ्रांस का वाइन उद्योग सचमुच समाप्त होते होते बचा। बोर्डो विश्वविद्यालय के प्रोफेसर मिलार्डे ने इसी बीच आकस्मिक रूप से "बोर्डो मिश्रण" या बोर्डो मिक्स्चर नामक कवकनाशी (फंगिसाइड) की खोज करके देश को इस दयनीय दशा से उबार लिया। पादप-रोग विज्ञान के इतिहास में यह एक महत्वपूर्ण घटना थी जबकि पौधों के रोगों का रासायनिक नियंत्रण होना शुरू हो गया। लेकिन सन् 1943 में अविभाजित बंगाल में मानवता के इतिहास का एक अभूतपूर्व अकाल पड़ा, जिसमें करीब बीस लाख आदमी मरे। इस अवधि में चावल की कम पैदावार का मुख्य कारण था पत्तियों का भूरा चकत्ता रोग (ब्राउन लीफ स्पॉट) जो हेल्मिंथोस्पोरियम ओरिज़ी नामक कवक के कारण फैला। पौधों के रोग विज्ञान सम्बन्धी साहित्य में सन् 1942 की बंगाल की इस पादप महामारी की तुलना सन् 1845 के आयरलैंड के आलू वाले अकाल से की गई।

इसके फलस्वरूप भारत में पादप रोगों समेत (रोग-विज्ञान) इनके कारणों का भी यानी कवकों का भी गम्भीर अध्ययन (कवकविज्ञान) आरम्भ किया गया और इस सदी के पहले दशक में पूसा (बिहार) में इम्पीरियल (अब भारतीय) कृषि अनुसंधान संस्थान की स्थापना हुई। इस इन्स्टीट्यूट को भारतीय कवकविज्ञान (माइकोलॉजी) और पादप रोगविज्ञान का जनक माना जाता है और ई० जे० बटलर इसका पहला इम्पीरियल माइकोलॉजिस्ट (कवकविज्ञानी) था। उसने इन सब बातों का अध्ययन करके फसलों के कई रोगों के लिए नियंत्रण के उपाय सुझाए जैसे कि अरहर, कपास और तिल की

ग्लानि (विल्ट), ताड़, पान, गन्ना, धान, आलू, मक्का, मूंगफली के रोगों तथा गेहूँ के किट्ट (रस्ट) आदि के नियंत्रण उपाय। उसने "फंगाइ एन्ड डिजीज़ेज इन प्लान्ट्स" (कवक और पौधों के रोग) नामक बहुत महत्व-पूर्ण पुस्तक लिखी। उसके समकालीन कुछ भारतीय पादप रोगविज्ञानी (पैथोलाजिस्ट) भी अपने-अपने कार्य की दृष्टि से प्रसिद्ध थे — आलू के विलंबित अंगमारी (लेट ब्लाइट) रोग के विशेषज्ञ जे० एफ० दस्तूर, ज्वार बाजरा की चूर्णी आसिता (डाउनी मिल्ड्यू) की खोज करने वाले जी०एस० कुलकर्णी, कपास की ग्लानि (विल्ट) तथा गन्ने के कंड (स्मट) के प्रसिद्ध अन्वेषक एस०एल० अजरेकर। सन् 1930 तक भारत में गेहूँ की किट्ट समस्या सम्बन्धी खोज के कारण के०सी० मेहता ने भी अपना नाम प्रसिद्ध कर लिया था। भारत के अन्य सुप्रसिद्ध कवक विज्ञानी और पादप-रोगविज्ञानी ये है: बी०बी० मंडकर, आर०एन० टंडन, टी०एस० सदाशिवन, एस०एन० दास गुप्ता, एम०जे० थिरुमलाचार, सी०वी०सुब्रह्मनियन और एस०पी०राय चौधरी।

बाद में इस संस्थान को नयी दिल्ली लाया गया जो पूसा रोड में स्थित है और पौधों के रोग विज्ञान सम्बन्धी अनुसंधान का सक्रिय केन्द्र है। भारतीय कृषि अनुसंधान परिषद् (इन्डियन काउन्सिल ऑफ ऐग्रीकल्चरल रिसर्च—आई० सी० ए० आर०) के अधीन सारे देश में कई अनु-संधान संस्थान हैं जो पौधों के रोगों के अनेक पहलुओं से सम्बन्धित खोजों में लगे हुए हैं। विशेष बल इसी बात पर दिया जा रहा है कि देश की बढ़ती आबादी के लिए आवश्यक अधिक खाद्य उत्पादन के निमित्त स्वस्थ व रोगमुक्त फसलों को उगाया जाय। पादप-रोगविज्ञान केवल रोग के लक्षणों का ही निरूपण नहीं करता बल्कि उसमें कारणात्मक जीव के जीवन-चक्र या हेतुविज्ञान (ईटियोलाजी), प्रकृति में उसके स्थायीकरण और नियंत्रण विधियों का भी अध्ययन होता है।

अंग्रेजी का "पैथोलॉजी" शब्द ग्रीक भाषा के दो शब्दों "पैथोस" (रोग या पीड़ा) और "लागोस" (व्यक्त करना या वर्णन) से व्युत्पन्न है और इसका पर्याय हिन्दी में भी इसी अर्थ में रोग विज्ञान या विकृति विज्ञान है, जो शब्द का एकदम प्रत्यक्ष बोध करा देता है।

## वर्गीकरण

पौधों के रोगों को कई प्रकार से वर्गीकृत किया जाता है: (i) कारणात्मक जीवों या रोगजनकों (पैथोजेन) की प्रकृति के अनुसार, (ii) रोगजनक द्वारा उत्पन्न लक्षणों के आधार पर, (iii) रोग होने की मात्रा के आधार पर, और (iv) प्रकृति में कारणात्मक जीवों की प्राप्ति, स्थायीकरण और संचरण की विधि के अनुसार।

### (1) रोगजनक आधार पर वर्गीकरण

रोगजनक या पैथोजेन क्या है ?— यह एक कर्त्ता या कारक है जो पीड़ा या कष्ट उत्पन्न करता है और हमेशा रोग से संबद्ध होता है। अंग्रेजी का पैथोजेन शब्द ग्रीक भाषा के **पैथोस** (पीडा या रोग) और **जेनेसिस** (उद्‌भव या उद्‌गम) शब्दों से व्युत्पन्न है, और हिन्दी का रोग-जनक शब्द तुरन्त अर्थ की सरल अभिव्यक्ति कर देता है।

ये रोगजनक असंख्य और विभिन्न प्रकार के होते हैं। सामान्यतया इनको **सजीव (ऐनिमेट)**, **विषाणविक (वाइलर)** और **निर्जीव (इनऐनिमेट)** समूहों में वर्गीकृत किया जाता है।

**सजीव रोगजनक** : स्वभाव में ये प्राय: सूक्ष्मजैविक (माइक्रोबियल) होते हैं। अन्य कुछ प्राणी उद्‌भव वाले है, जैसे कि सूत्रकृमि (निमेटोड) और कीट, जो रोग पैदा करते हैं। सूक्ष्मजैविक रोगजनकों में महत्वपूर्ण भूमिका कवकों की और फिर जीवाणुओं (बैक्टीरिया) की है। **हेल्मिथोस्पोरियम ओरिज़ी** धान की पत्तियों का भूरा चकत्ता रोग उत्पन्न करता है और **जैंथोमोनास माल्वा-सीएरम** नामक जीवाणु से कपास का **कृष्ण शाखा** (ब्लैक आर्म) रोग होता है। आम की कुरचनाएँ चिचड़ियाओं (माइट) के कारण होती हैं।

**विषाणविक (वाइलर) रोगजनक** : यह अभी तक समस्या बनी हुई है कि विषाणुओं (वाइरसों) को सजीव माना जाय या निर्जीव। ये कुछ भी हों पर इतना जरूर है कि ये रोग उत्पन्न करते हैं और इसलिए इनको रोगजनक माना गया है और पृथक रूप से इनको यहाँ लिया गया है। विषाणुओं या वाइरसों द्वारा उत्पन्न होने वाले कुछ रोग है— मोज़ेक, शिरा स्पष्टता (वीन क्लियरिंग) हरित रोग (क्लोरोसिस) आदि।

**निर्जीव रोगजनक** : कई रोग ऐसे होते हैं जिनको किसी भी रोगजनक से सम्बद्ध नहीं किया जा सकता। ऐसे रोगों के सामान्य उदाहरण हैं—फूलगोभी का ह्विपटेल रोग और सेब का कच्छु (रोग) या ऐपल स्कैब। फूलगोभी का ह्विपटेल रोग भूमि में मोलिबडेनम की कमी और सेब का कच्छु रोग शीत संग्रहण (कोल्ड स्टोरेज) में श्वसन के कारण सेब के गैसीय उत्पादों के कारण होता है। इस प्रकार के रोगजनक निर्जीव प्रकार के होते है और इनमें रसायन गैस, धुँआ, खनिज पोषक, नमी, तापमान आदि सम्मिलित हैं। वातावरण मे इनकी कमी या वेशी से रोग हो सकता है। धान का महत्वपूर्ण 'खैरा' रोग भूमि में जस्त (जिंक) की कमी के कारण होता है।

**(2) लक्षण परपोषी के आधार पर वर्गीकरण**

परजीवी की आपसी क्रिया के परिणाम स्वरूप लक्षण उत्पन्न होता है। रोगजनक की वृद्धि परपोषी (होस्ट) की सतह पर प्रायः चूर्णी या रूई-जैसे पुंज के रूप में होती है। अन्य में परपोषी विरूपित या विकृत हो जाते है लेकिन कुछ में परपोषी और परजीवी की आपसी भीतरी क्रिया के कारण सारा पौधा मुरझा जाता है (सिस्टीमिक)। विभिन्न रोगजनकों द्वारा उत्पन्न लक्षण निम्नलिखित है :

**(क) आसिता (मिलड्यू)** : रोगजनक परपोषी की सतह पर एक सतही रचना के रूप में रहता है। मृदुरोमिल (डाउनी) आसिता के रोगजनक रुईदार मृदुरोमिल रचनाओं और चूर्णी (पाउडरी) आसिता में कवक की सतह पर चूर्ण या चूरे के रूप में दिखलाई देते हैं। उदाहरणतः **स्क्लेरोस्पोरा ग्रेमिनीकोला** द्वारा उत्पन्न होने वाली **पेनीसीटम टायफाइडिस** (बाजरा) की मृदुरोमिल आसिता (डाउनी मिल्ड्यू) या हरी बाली (ग्रीन इयर) तथा अंगूर (**वाइटिस विनिफेरा**) की चूर्णी आसिता (पाउडरी मिल्ड्यू) जो **अन्सिनुला निकेटर** द्वारा उत्पन्न होती है।

**(ख) किट्ट (रस्ट)** : इसका लक्षण यह है कि देखने में यह जंग जैसा या लाल रंग का होता है। बाह्य-त्वचा (एपिडर्मिस) के नीचे स्फोट या छाले जैसी रचनाएँ उत्पन्न होती हैं जो उसे तोड़कर अंत में बीजाणुओं (स्पोर) के समूह को बिखेर देती हैं। ये स्फोट रंग में पीले, लाल, भूरे या काले कुछ भी हो सकते हैं। उदाहरण **पक्सीनिया ग्रैमिनिस ट्रिटिसी** द्वारा उत्पन्न गेहूँ के तने का किट्ट (रस्ट)।

**(ग) कंड (स्मट)** : कंड या स्मट शब्द का अर्थ है कज्जली या कोयले-जैसा चूर्ण। इस प्रकार के लक्षण अधिकांशतया पुष्पक्रमों (इनफ्लोरेसेन्स) में देखे जाते हैं। पौधे के ग्रस्त भाग काले बीजाणु पुंज में बदल जाते हैं। गन्ने के कंड रोग में, सारा पुष्पी अक्ष काली या भूरी रचना में बदल जाता है, और उसमें यह रोग अस्टिलागो सिटामिनी द्वारा होता है। गेहूँ का श्लथ कंड (लूज़ स्मट) **अस्टिलागो ट्रिटिसी** द्वारा उत्पन्न होता है।

**(घ) सफेद फफोले** : तने व पत्तियों पर स्फोट या छाले जैसी रचनाएँ उत्पन्न हो जाती हैं। ये स्फोट (पुस्ट्यूल) संक्रमित पुष्पक्रमों में ऊपर उठे हुए और चमकदार सफेद रहते है। फूल वाले भाग विविध प्रकार से विरूपता या विकृति वाले होते हैं। उदाहरणः **ऐल्बूगो कैंडिडा** द्वारा उत्पन्न होने वाला सरसों कुल के पौधों का सफेद किट्ट (रस्ट)।

**(ङ) कच्छु (स्कैब)** : इसका अर्थ है सतह पर दिखने वाली पपड़ी। परपोषी पौधे (होस्ट) की सतह व्रण या घावों के कारण रुक्ष यानी रूखी बन जाती है। उदाहरण : पोडोस्फेरा ल्यूकोट्राइका द्वारा उत्पन्न सेब का कच्छु रोग (स्कैब)।

**(च) स्क्लेरोशिया** : स्क्लेरोशिया कवकतंतुओं (हाइफा) के बड़े व घने पुंज होते हैं जो विभिन्न रोगजनकों द्वारा बनते हैं। रंग में ये बैंगनी, भूरे या काले होते है। उदाहरण : **क्लेविसेप्स परप्यूरिया** द्वारा उत्पन्न राई का अर्गट रोग।

**(छ) रिसाव (एक्सूडेशन)** : यह एक ऐसा लक्षण है जो जीवाणुओं (बैक्टीरिया) के रोगों से सम्बद्ध होता है। जीवाणु परपोषी के शरीर से बाहर रिस कर निकल आते हैं और परपोषी की सतह पर ये पतली परत या झिलमिलाती बूँदों के रूप में दिखलाई देते हैं। उदाहरणः **जैंथोमोनास ओरिज़ी** द्वारा उत्पन्न धान का जीवाणविक अंगमारी (बैक्टीरियल ब्लाइट)।

**(ज) रंग परिवर्तनः** ऐसा आम तौर पर विषाणु या वाइरस-रोगों (वाइरल डिजीज) के कारण होता है। पौधों में भिन्न-भिन्न रंगों के नमूनों के लिए विभिन्न शब्दों का प्रयोग किया जाता है। हरित रोग (क्लोरोसिस) समूची पत्ती का सफेद या पीला होना है। कभी-कभी रंग

के ये परिवर्तन मोजेक नमूना बना देते हैं। शिरा स्पष्टता (वीन क्लियरिंग) ऐसा लक्षण है जिसमें शिराओं के नजदीक वाले ऊतक पीले हो जाते है और बाकी क्षेत्र हरा ही रहता है। जब शिराओं के नजदीक वाले ऊतक हरे ही रहते हैं और बाकी भाग हरित रोग से ग्रस्त हो जाता है तो इसे शिरा-पट्टन (वीन बैंन्डिग) कहते है।

**(झ) अतिवृद्धि (हाइपरट्रॉफी या ओवरग्रोथ)** : इसमें पौधों के भागों या अंगों में रोगजनक या पैथोजेन द्वारा आकार में अपसामान्य वृद्धि हो जाती है। इसे अति-वर्धन (हाइपरप्लेसिआ) और अतिवृद्धि कहते है। अतिवर्धन कोशिकाओं की संख्या में बढ़ोतरी है और अतिवृद्धि कोशि-काओं की पृथक रूप से आकार में वृद्धि है। इस प्रकार से होने वाली वृद्धि कई नामों से जानी जाती है, जैसे कि पिटिका (गॉल), मुद्गर-मूल (क्लब रूट), मूल-गाँठ (रूट-नॉट) आदि। उदाहरण: **कोरिएन्ड्रम सैटाइवम** धनिया के तने की पिटिका, जो **प्रोटोमाइसीज मैक्रोस्पोरस** से उत्पन्न होती है।

**(ञ) क्षीणता (एट्राफी) या अववृद्धि (अन्डर ग्रोथ)** : कभी-कभी पौधों के भाग आंशिक या पूर्ण रूप से बहुत कम वृद्धि कर पाते हैं। उदाहरण: **पैरेनोस्पोरा ब्रेसिका** द्वारा सरसों के पौधे में आक्रमण होने पर फूलों की कलियां की वृद्धि रुक जाती है।

**(ट) कूचीसम रोग (विचेज ब्रूम)** : एक सीमित क्षेत्र से कई लम्बी शाखाएं निकलती हैं, जो झाड़ू जैसी दिखाई देती हैं। इसका सामान्य उदाहरण आम के पुष्प-क्रम का कूचीसम रोग है।

**(ठ) ऊतकक्षय (नेक्रोसिस)** : इसका अर्थ है कोशि-काओं, ऊतकों तथा अंगों की मृत्यु। कोशिकाओं की मृत्यु कभी-कभी एक छोटे क्षेत्र तक सीमित होकर धब्बों के रूप में दिखाई देती है।

पत्तियों के धब्बे कवकों द्वारा उत्पन्न सामान्य लक्षण है। पत्तियों के कुछ धब्बों या चकत्तों में, चकत्ते का मृत ऊतक फेंक दिया जाता है जिसके कारण गोल छेद बन जाते हैं जिन्हें विस्फोट छिद्र (शॉट होल) कहते हैं। ये चकत्ते धारियों में भी हो सकते है।

**(ड) अंगमारी (ब्लाइट)** : अंगमारी से पत्ती या पौधे के भागों के जले होने का आभास होता है। यह रोगजनक के कारण पत्तियों की तात्कालिक मृत्यु के परिणामस्वरूप होता है।

उदाहरण : **फाइटोफोरा इनफेस्टेन्स** द्वारा उत्पन्न *आलू का विलम्बित अंगमारी (लेट ब्लाइट)।*

**(ढ) आर्द्रपतन (डेंपिंग ऑफ)** : कुछ दशाओं में कई मृतजीवी कवक (सैप्रोफिटिक फंगाइ) प्रायः नवोद्भिदों (सीडलिंग) का आर्द्रपतन करते हैं। ये तने के आधार (बीजपत्राधार—हाइपोकोटिल) या जड़ों पर आक्रमण करते हैं जिससे उस क्षेत्र का ऊतक कमजोर हो जाता है और इसके परिणामस्वरूप नवोद्भिद गिर जाता है।

उदाहरण : पिथियम की जातियाँ तम्बाकू के नवोद्-भिदों का आर्द्रपतन रोग करती हैं।

**(ण) म्लानि (विल्ट)** : कुछ उदाहरणों में सारा पौधा मुरझा जाता है। यह या तो संवहन-ऊतकों (वैस्कुलर टिश्यू) में रोगजनक के जमा होने के कारण, जिससे पानी व भोजन की गतिशीलता रुक जाती है, या इनके द्वारा आविषालु (टाक्सिक) या विषैले पदार्थों के स्रवण के कारण होता है।

उदाहरण : **फ्युजेरियम ऑक्सीस्पोरम** एफ० क्यूबेन्सी से उत्पन्न केले की म्लानि।

**(त) कैंकर** : कैंकर तने की छाल या वल्कुट (कोर्टेक्स) पर का मृत क्षेत्र है।

उदाहरण : **जैंथोमोनास सिट्री** द्वारा उत्पन्न सिट्रस (नींबू कुल के पौधों) कैंकर।

## (3) रोग होने की मात्रा के आधार पर वर्गीकरण

प्रकृति में रोगों के होने के अनुसार वे **स्थानिक (एन्डीमिक)**, जानपदिक या महामारी **(एपिडेमिक)** अथवा **कदाचनिक (स्पोरेडिक)** होते हैं।

यदि कोई रोग किसी क्षेत्र में हर साल हल्के या उग्र रूप में होता रहता है तो उसे स्थानिक कहते हैं। *जानपदिक या महामारी* वे रोग हैं जो व्यापक रूप से होते हैं लेकिन आवधिक रूप से नहीं होते। जब पूरा पौधा ग्रसित होता है तो उसे दैहिक (सिस्टीमिक) कहते हैं। कदाचनिक वे रोग हैं जो कभी-कभी ही होते हैं।

### (4) कारणात्मक जीवों के पाए जाने, स्थायीकरण और संचरण के आधार पर वर्गीकरण

रोगों को प्रकृति में उनके बने रहने के आधार पर भी वर्गीकृत किया जा सकता है, जैसे . (क) बीजोढ़ (सीड बोर्न), (ख) मृदोढ़ (सॉयल बोर्न), (ग) जलोढ़ (वाटर बोर्न) तथा (घ) वातोढ़ (एयर-बोर्न)। वे रोगजनक जो भूमि में बने रहकर उसके द्वारा संचरित होते हैं मृदोढ़ रोगकारक कहलाते हैं। इसी तरह बीज, पानी और हवा में बने रहने और उनके द्वारा संचरित होने वाले रोगकारक क्रमशः बीजोढ़, जलोढ़ और वातोढ़ कहलाते हैं। कई रोग अपने जीवन-चक्र की एक अवस्था में मृदोढ़ और दूसरी अवस्था में बीजोढ़ हो सकते हैं।

इस पाठ्य सामग्री में रोगों के विस्तृत वर्णन में ऊपर दिए गए वर्गीकरण को ही आधार माना गया है।

## पौधों के रोगों का नियंत्रण

पादप रोगों के नियंत्रण की कई विधियाँ हैं। लेकिन किसी रोग का नियंत्रण करने के पहले निम्नलिखित बातों की पूरी जानकारी आवश्यक है: सम्बद्ध कारणात्मक जीव या स्वभाव, रोगजनक का जीवन-चक्र, रोगजनक सजीव है या निर्जीव, प्रकृति में रोगजनक (पैथोजेन) के जीवित बने रहने की क्या विधि है, निर्धारक कारक जैसे रोग की स्थापना को प्रभावित करने वाली वातावरणी दशायें तथा वे कारक जो उसका प्रसार करते हैं। अतः प्रत्येक प्रारूप (टाइप) यानी प्रकार और रोग के स्वभाव के कारण नियंत्रण उपाय बदलता रहता है। सोच-विचार कर ही विवेकपूर्ण ढग से विधि का चुनाव करना चाहिए। पौधों के नियंत्रण पर तीन मुख्य पहलुओं से विचार किया जाता है :

(i) **रोग निरोधी (प्रोफाइलैक्टिक)** उपाय वे है जिनमें स्वस्थ पौधों को रोगजनक के संपर्क से बचाया जाता है।

(ii) **चिकित्सीय (थीराप्यूटिक)** उपाय वे है जिनमें पहले से रोगी पौधों के उपचार के लिए सुझाव दिए जाते हैं।

(iii) **प्रतिरक्षीकरण (इम्यूनाइजेशन)** उपाय वे हैं जिनमें रोग से लड़ने के लिए पौधों की रोधक्षमता में सुधार किया जाता है।

## रोग निरोधी उपाय

**बहिष्कार :** निम्नलिखित सावधानियाँ बरतने पर कुछ रोगों को दूर किया या उनसे बचा रहा जा सकता है :

**(क) संगरोध (क्वारन्टाइन)** : सन् 1914 में भारत सरकार ने "विनाशी कीट तथा पीड़क अधिनियम" (डिस्ट्रक्टिव इनसेक्ट्स एन्ड पेस्ट्स ऐक्ट—डी० आई०पी० ऐक्ट) पास किया, जिसके अनुसार देश में रोगी पादप-सामग्री का प्रवेश वर्जित है। केवल प्रमाणीकृत बीज या पादप सामग्री को ही देश में लाने दिया या उगाने वालों के पास आने दिया जाता है। ये संगरोध केन्द्र प्रत्येक बड़े हवाईअड्डे व बन्दरगाह पर यही कार्य करते हैं और देश में रोगी पदार्थों की प्रविष्टि नही होने देते। शुरू में तो ऐसे रोगी पदार्थों को रोकने का कोई नियम नही था और इस तरह आलू का विलम्बित अंगमारी रोग (लेट ब्लाइट) आयरलैंड में दक्षिणी अमरीका से प्रविष्ट हुआ।

**(ख) उन्मूलन (इरेडिकेशन)** : रोगों से बचने का यह दूसरा लाभदायक उपाय है। उन्मूलन द्वारा रोग से बचने के लिए निम्नलिखित विधियाँ अपनाई जाती हैं :

(i) **सस्यावर्तन (क्रॉप रोटेशन)** : एक विशेष फसल को लगातार बोने पर रोगजनक का निवेश द्रव्य (इनॉकुलम) उग्र हो जाता है। फसल का आवर्तन करने या बदलने यानी असंवेदनशील परपोषी उगाने से रोगजनक दूर हो जाता है क्योंकि ऐसा करने से उपयुक्त परपोषी पौधे या पौधे के अवशिष्ट पदार्थ प्राप्त नहीं हो पाते। **फ्युजेरियम आडम** द्वारा उत्पन्न अरहर (**कैजेनस कैजन**) की म्लानि तथा **फाइटोफ्थोरा निकोटियानी** किस्म **पैरासिटिका** और **स्क्लेरोटियम राल्फसिडी** द्वारा उत्पन्न पान (**पाइपर बीटल**) का पाद विगलन (फूट रॉट) रोग को दूर करने के लिए सस्यावर्तन का प्रयोग किया जाता है।

(ii) **एकांतर (आल्टर्नेट) परपोषियों तथा संपार्श्विक (कोलटेरल) परपोषियों का निराकरण :**

एकांतर परपोषियों के निराकरण से रोग

का स्थायित्व और प्रसार रुक जाता है। संयुक्त राष्ट्र अमरीका में बारबेरी की झाड़ियों के उन्मूलन से गेहूं के काले तने वाले किट्ट का नियंत्रण किया जा सका, क्योंकि बारबेरी एकान्तर परपोषी था। भारत में धान के प्रध्वंस (ब्लास्ट) के नियंत्रण के लिए यही विधि सुझाई गई है क्योंकि यहाँ कुछ बहुवर्षी घासीय परपोषी (संपार्श्विक या कोलेटरल) प्राथमिक निवेश द्रव्य या इनॉकुलम के स्रोत है।

(iii) **रोगी पौधों का अपवांछन (रोगिंग)** : पौधों के विषाणु या वाइरस रोगों के दैनिक नियंत्रण में ग्रस्त पौधों का अपवांछन या निराई अच्छी विधि है।

(iv) **खेत की स्वच्छता** : यह विधि तब प्रयुक्त की जाती है जब रोगजनक या तो भूमि में या रोगी पौधे के कचरे में पनपते जाते है। विविध उपाय ये है . रोगी पौधे के कचरे का निराकरण और उसको जला देना, रोगी पौधे और उसके भागों को गहरी जुताई द्वारा दबा देना, गरमी के मौसम में गहरी जुताई, और पौधे के गिरे या झड़े कचरे को रसायनों द्वारा विसंक्रमित (डिसइनफैक्ट) करना।

(v) **बीजोढ़ निवेश द्रव्य का उन्मूलन** : कई रोग बाहरी या भीतरी रूप से बीजोढ़ होते हैं। स्वस्थ बीजों को अलग करने के लिए छानने और पानी या नमक के विलयन में डुबोने की विधियों का इस्तेमाल किया जाता है। फार्मेल्डीहाइड, या पारे, तांबे या गंधक के यौगिक से बीज का रासायनिक उपचार करने पर बीज की बाहरी सतह पर लगा निवेश द्रव्य (इनॉकुलम) नष्ट हो जाता है। अन्दर से बीजोढ़ रोगजनक, जो भ्रूण में गहरे जमे हो सकते हैं, गरम पानी या सूर्य के उपचार से नष्ट हो जाते हैं।

(vi) **जैविक नियंत्रण** : इसका अर्थ है एक जीवधारी की सहायता से रोगकारी जीव का नियंत्रण। इससे रोगजनक द्वारा होने वाले रोग में बहुत कमी आ जाती है। उदाहरण के लिए, कोई रोगजनक, कोई सूत्रकृमि (निमैटोड) या कवक किसी दूसरे कवक या जीवाणु (बैक्टीरियम) द्वारा परजीवीकृत (पैरासिटाइज्ड) किया जा सकता है। प्रायः भूमि में साथ-साथ रहने वाले सूक्ष्मजीवों में परस्पर विरोध पाया जाता है क्योंकि कुछ जीव औरों की वृद्धि का संदमन (इनहिबिशन) करते हैं यानी दबा देते हैं। परपोषी की सतह पर एक जीव दूसरे से प्रतियोगिता करता है और वातावरण में परिवर्तन लाकर विरोधी सूक्ष्मजीवों या रोगाणुओं (माइक्रोब) की वृद्धि को उद्दीपित कर रोगजनक (पैथोजेन) को संदमित किया जा सकता है। कुछ उच्चतर पौधों की जड़ें ऐसे आविषालु (टाक्सिक) पदार्थों का स्रवण करती हैं जो रोगजनक पर रोक रखते हैं।

(vii) **रसायनों का रक्षात्मक अनुप्रयोग** : जब इस बात की आशा की जाती है कि रोग वातोढ़ निवेश द्रव्य के कारण होगा तो नियंत्रण उपायों के रूप में परपोषी (होस्ट)की सतह पर विशिष्ट आविषालु पदार्थों का प्रयोग किया जाता है। प्रयुक्त किए जाने वाले ये पदार्थ, जो कि रोगजनक के प्रति तो आविषालु या टॉक्सिक होते हैं लेकिन परपोषी के प्रति नहीं,—गंधक, तांबे, जस्त, निकल, मैंगनीज आदि के यौगिक हैं। इन्हें फुहार या धूलि (चूर्ण) के रूप में छिड़का जाता है।

## चिकित्सीय उपाय

चिकित्सा या थिरैपी उस पौधे के उपचार का उपाय है जो कि पहले से ही रोगी हो चुका हो। प्रयत्न किया जाता है कि पौधा ऐसे लक्षणों से मुक्ति पा सके और रोगजनक (पैथोजेन) द्वारा पहुँचे नुकसान की मरम्मत या क्षतिपूर्ति कर सके। चिकित्सा के दौरान रोग के कारण का निराकरण कर दिया जाता है जिससे कि पौधे के शारीरिक क्रिया-कलाप सामान्य हो सकें। चिकित्सीय उपाय दो प्रकार के होते हैं : (क) भौतिक चिकित्सा और (ख) रसायन चिकित्सा (कीमोथिरैपी)।

**(क) भौतिक चिकित्सा** : इस विधि में रोग से लड़ने के लिए भौतिक साधनों का प्रयोग किया जाता है, जैसे कि शल्य आर्द्रता और तापमान के उपचार। बढ़ती जाने और अधिक होने वाली क्षति को रोकने के लिए पौधे के संक्रमित भागों को निकाल दिया जाता है। कोशिका के अन्दर की (अंतः कोशिक) नमी ऐसा कारक है जो कई पौधों में रोग के परिवर्धन से सम्बद्ध होता है। ऐसे में रोगी पौधों का उपचार अंतः कोशिक नमी का नियंत्रण करके किया जाता है। इससे जीवाणविक (बैक्टी-

रियल) मृदु गलन (सॉफ्ट रॉट) तथा अन्य रोगों में कमी आ जाती है। पूतिरोधियों (ऐंटीसेप्टिक) वाले या बिना पूतिरोधी वाले गरम पानी में डुबाने पर रोग का नियंत्रण होता देखा गया है।

**(ख) रसायन चिकित्सा** : रोगजनक स्थानिक रूप से किसी क्षेत्र या ऊतक की केवल सतह वाली कोशिकाओं को संक्रमित कर सकता है या क्षति पहुँचा सकता है। साथ ही सर्वांग रूप से पौधे के समूचे भाग पर आक्रमण हो सकता है। इस प्रकार ऊपर बताए गए संक्रमण के प्रकारों में पहले वाले उपचार को स्थानिक (टौपिकल) रसायन चिकित्सा और बाद वाले संक्रमण के उपचार को सर्वांगी रसायन चिकित्सा (सिस्टीमिक कीमोथिरैपी) कहते हैं। रसायन चिकित्सा में रोग के साथ रसायनों द्वारा लड़ा जाता है जो दशा के अनुसार स्थानिक रूप से या सर्वांग रूप से कार्य करते हैं। चिकित्सा वाला यह रसायन एक यौगिक होता है जो प्रत्यक्ष या अप्रत्यक्ष रूप से ठीक करने वाले या रोग कम करने वाले असर की शुरुआत करता है।

कई रोगों में स्थानिक रूप से रसायन चिकित्सा या रसोचिकित्सा द्वारा व्यापारिक पैमाने पर सफलता प्राप्त कर ली गई है। जीवाणुओं (बैक्टीरिया) तथा कवकों द्वारा भीतर से संक्रमित बीजों को उपयुक्त सांद्रता में डायाथायोकार्बमेट, फीनोल, फौर्मल्डीहाइड, वाष्प से उपचारित किया जाता है जो बीज के अन्दर प्रविष्ट होकर रोगजनक को स्वस्थाने (इन सिटु) मार देते हैं।

रोपण या बोने से पहले आलू के संक्रमित कंदों को फोर्मेलीन या मरक्यूरिक क्लोराइड के विलयन में डुबोया जाता है। सर्वांगी रसायन चिकित्सा में रोगजनक को परपोषी पौधे के दूर से दूर वाले पत्रक (लीफलेट) तक भी नहीं छोड़ा जाता। पौधे के भीतर रसायन सर्वांग रूप से वितरित होकर रोगजनक को प्रत्यक्ष आविषालु क्रिया से मार देते हैं। रसायन जड़ों द्वारा भी सोखे जाकर पत्तियों तक पहुँचा दिए जाते हैं। रसायन चिकित्सा से सम्बद्ध रसायनों के उदाहरण हैं -- फेनिल-मरकरी-ऐसीटेट, सल्फानिलामाइड तथा सम्बन्धी सल्फा-यौगिक, प्रतिजैविक (एन्टीबायोटिक) और ऑक्सिन।

## पौधों के रोगों के नियंत्रण में इस्तेमाल किए जाने वाले सामान्य कवकनाशी (फंगिसाइड) और प्रतिजैविक (ऐण्टीबायोटिक)

**(i) बोर्डो मिश्रण (बोर्डो मिक्सचर)** : यह 50 गैलन पानी में घुला हुआ 4:4 के अनुपात में नीले थोथे (कॉपर सल्फेट) और चूने का मिश्रण है। सन् 1878 से, जब से इसकी खोज हुई तब से यह उत्तम कवकनाशियों में से एक है। आर्थिक दृष्टि से कई महत्वपूर्ण फसलों के रोगों के नियंत्रण में इसका व्यापक प्रयोग होता है, जैसे अंगूर के मृदुरोमिल आसिता रोग (डाउनी मिल्ड्यू), मूँगफली के टिक्का रोग और काफी किट्ट (रस्ट) आदि में।

**(ii) गंधक धूलि (सल्फर डस्ट)** : आकार्बनिक गंधक बहुत पुराना और व्यापक रूप से प्रयुक्त किया जाने वाला कवकनाशी है। आदिकालीन यूनानी भी इसका उपयोग जानते थे। इसे चूरे या चूर्ण रूप में या गीले रूप में इस्तेमाल किया जा सकता है, जिसे धूलि के रूप में छिड़का अथवा फुहारा जा सकता है। गंधक की धूलि का प्रयोग चूर्णी आसिता (पाउडरी मिल्ड्यू) के नियंत्रण में किया जाता है।

**(iii) भारी धातुओं वाले कार्बनिक यौगिक** : ऐग्रोसेन जी०एन०, गर्सन और टिलेक्स पारे के कार्बनिक यौगिक हैं जिनका इस्तेमाल बीज-उपचार में किया जाता है। इनके प्रयोग से कई बीजोढ़ रोगों के नियंत्रण में अच्छे परिणाम प्राप्त हुए हैं, जैसे कि धान की पत्ती के भूरे चकत्ते वाले रोग में। डायाथायोकार्बमेट कवकनाशी, जैसे कि डायाथेन एम-45, डायाथेन जेड-78, मूँगफली के टिक्का रोग का नियंत्रण करते हैं। धान्यों, सब्जियों और फल वाली फसलों आदि का आल्टर्नेरिया अंगमारी रोग (ब्लाइट) डायाथेन एम-22 तथा डायाथेन एस-31 से नियंत्रित रहता है।

**(iv) कवकनाशियों के रूप में प्रतिजैविकों का इस्तेमाल** : रोगकारी कवकों तथा जीवाणुओं (बैक्टीरिया) का नियंत्रण करने के लिए कई प्रतिजैविकों (ऐन्टीबायोटिक) का इस्तेमाल किया जाता है। पौधों के रोगों के नियंत्रण में पेनीसिलिन, स्ट्रेप्टोमाइसिन, साइक्लोहेक्सिमाइड, ग्रिसियोफल्विन और विरिडिन का प्रयोग किया जाता है।

जीवाणु या बैक्टीरियाई रोगों के नियंत्रण में स्ट्रेप्टो-माइसिन बहुत प्रभावकारी है। ये रोग बहुत लम्बे समय से अनियंत्रित थे। साइक्लोहेक्सिमाइड और ग्रिसियोफल्विन कवकविरोधी प्रतिजैविक (एन्टीबायोटिक) हैं जो सचमुच बहुत प्रभावकारी पाए गए हैं। ऐग्रिमिसिन धान के जीवाणु-अंगमारी (बैक्टीरियल ब्लाइट) पर और ब्लास्टि-सिडिन धान के प्रध्वंस रोग (ब्लास्ट) पर नियंत्रण रखता है।

## प्रतिरक्षीकरण उपाय

पादप रोगों को प्रभावशील ढंग से नियंत्रित करने के लिए प्रतिरक्षीकरण (इम्म्यूनाइज़ेशन) उपाय सबसे उत्तम साधन है। परजीवी कारणात्मक साधनों द्वारा परपोषी पौधे संक्रमण के प्रति प्रतिरक्षित (इम्म्यून) या रोधी बना दिए जाते हैं। रोधी किस्मों (रेसिस्टेंट वैराइटीज़) को निम्नलिखित तरीकों से प्राप्त किया जा सकता है :

**(क) रोगरोधी किस्मों का वरण (चुनाव) :** पौधों की महामारियों के दौरान प्रायः यह पाया जाता है कि खेती वाली एक अच्छी किस्म के अन्तर्गत औरों की अपेक्षा कुछ पौधे अधिक रोगरोध दिखलाते हैं। ऐसे पौधों का सावधानीपूर्वक चयन करने और बड़े पैमाने पर उनकी खेती करने से अधिक रोगरोध गुणता वाली किस्में उत्पन्न होती हैं।

**(ख) पौधों की प्रविष्टि :** फसल सुधार की विधियों में पौधों की प्रविष्टि एक बहुत पुरानी विधि है। यह एक आम बात रही है कि दूर के क्षेत्रों वाले उन पौधों की नई किस्में अनेक रोगों से ग्रस्त नए क्षेत्रों में प्रविष्ट की जाती हैं, जिन्होंने पुराने क्षेत्र में अच्छे परिणाम दिए होते हैं। पौधों को प्रविष्ट करने की यह प्रणाली सामान्यतया दूर के इलाकों या विभिन्न जलवायु-दशाओं वाले देशों के बीच अपनाई जाती है।

**(ग) रोगरोधी किस्मों का प्रजनन (ब्रीडिंग) :** स्थाई रूप से रोगरोधी किस्मों का प्रजनन करना पादप रोगों के नियंत्रण की सबसे उत्तम विधि है। यह मालूम किया गया है कि यह रोध कुछ आनुवंशिक (जीनेटिक) कारकों द्वारा उत्पन्न होता है। पहले, परपोषी (होस्ट) के उन शरीरक्रियात्मक और शारीरीय (ऐनाटोमिकल) लक्षणों का विस्तार से अध्ययन किया जाता है जो कि रोगजनक (पैथोजेन) के आक्रमण के प्रति रोध दृष्टि से लाभकारी होते हैं। फिर रोगजनक तथा रोग की प्रक्रिया की विस्तृत जानकारी प्राप्त की जाती है। इसके बाद रोगरोधी किस्म और रोग-संवेदनशील किस्म के जनकों में परस्पर संकरण (क्रास) कराया जाता है और इस तरह एक नई किस्म निकल आती है, सामान्यतया जिसका कर्षण किया जाता है। खेत की दशाओं में हरित बाली रोग (ग्रीन इयर डिजीज़) के प्रति बाजरा का उन्नत के०आई०विभेद (स्ट्रेन) अच्छा रोध दिखलाता है।

## अभ्यास

1. पौधों के रोगों के अन्य सामान्य लक्षण क्या है ?
2. निम्नलिखित के बारे में संक्षिप्त ऐतिहासिक टिप्पणी लिखो :
   (क) बंगाल का अकाल।
   (ख) आयरलैंड का आलू का अकाल।
   (ग) कवकविज्ञान (माइकोलॉजी) तथा पादप रोगविज्ञान (प्लान्ट पैथोलॉजी)।
   (घ) बोर्डो मिश्रण।
3. तुमने जिन विषाणु (वाइरसी या वाइरल), जीवाणु (बैक्टीरियल) और कवकीय (फंगल) रोगों का अध्ययन किया है उनमें से प्रत्येक का एक उदाहरण दो। इनमें से किसी एक के लक्षणों का वर्णन करते हुए नियंत्रण उपायों को बतलाओ।

4. निम्नलिखित में से किन्हीं दो पर अपने विचार प्रकट करो :
   (क) रोग के परिवर्धन में प्रवर्तनपूर्व कारक(प्रीडिस्पोजिंग फैक्टर) महत्वपूर्ण भूमिका निभाते हैं।
   (ख) रोग नियंत्रण में रोग निरोधी उपाय उत्तम साधन हैं।
   (ग) रसायन चिकित्सा वाला रसायन, रोगजनक (पैथोजेन) को परपोषी पौधे की पत्ती के सिरे तक बख्शता नहीं।
5. पादप रोगों का वर्गीकरण कैसे किया गया है ?
6. तन्दुरुस्त पौधे को रोगी पौधे से स्पष्ट करते हुए उनका आपसी अन्तर स्पष्ट करो।

# अध्याय-28

# भारत में पौधों के कुछ महत्वपूर्ण रोग

पौधों के महत्वपूर्ण रोगों का निम्नलिखित शीर्षों के अन्तर्गत आसानी से अध्ययन किया जा सकता है . (क) बीजोढ़, (ख) मृदोढ़, (ग) वातोढ़, तथा (घ) वे जो पौधे के भागों द्वारा फैलते हैं।

## (क) बीजोढ़ (सीड बोर्न) रोग

भारत में फसलों के महत्वपूर्ण बीजोढ़ रोग ये हैं : (1) धान की पत्ती का तिल चकत्ता रोग (सीसेम लीफ स्पॉट ऑफ राइस), (2) बाजरा का अर्गट रोग, (3) गन्ने का लाल विगलन (रेड रॉट), (4) धान का जीवाणु-अंगमारी रोग (बैक्टीरियल ब्लाइट) और (5) कपास का कृष्ण शाखा रोग (ब्लैक आर्म)। प्रकृति में बीजोढ़ रोगजनकों (पैथोजेन) का एक सामान्य प्रकार का रोग-चक्र होता है। एक ऐसे रोग-चक्र को चित्र 28.1 द्वारा समझाया गया है। यह चक्र हर रोग में अलग-अलग हो सकता है। ये रोग लक्षणों, रोग-चक्रों तथा नियंत्रण की विधियों सहित नीचे वर्णित किए गए हैं।

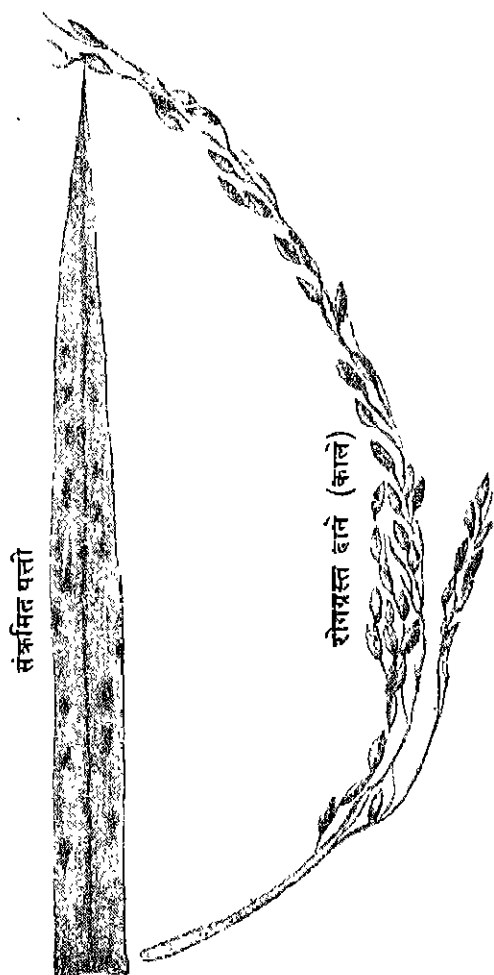
चित्र 28.1 : धान की पत्ती का तिल-जैसे चकत्ते वाले रोग का चक्र (बीजोढ़ : सीड बोर्न)।

### (1) धान की पत्ती का तिल चकत्ता या भूरा चकत्ता रोग

### रोगजनक : हेल्मिथोस्पोरियम ओरिज़ी (कवक)

हेल्मिथोस्पोरिओज या पत्ती के भूरे चकत्ते वाले रोग से सन् 1918-19 में कृष्णा-गोदावरी के क्षेत्र में तथा सन् 1942 में अविभाजित बंगाल में धान की उपज को भारी नुकसान पहुँचा था। दाने की उपज में 50 से 90% तक का नुकसान पाया गया। यह रोग देश के दक्षिणी और पश्चिमी क्षेत्रों में अधिक पाया जाता है।

धान उगाने वालों को रोग के आरम्भ और परिवर्धन सम्बन्धी कारकों व दशाओं की सही जानकारी होने से वे रोगरहित खेती करने की योजना अच्छी तरह बना सकते हैं।

**लक्षण** : पत्तियों, पर्णच्छदों (लीफ शीथ) और तुषों (ग्लूम्स) में छोटे-छोटे गोल भूरे चकत्ते नजर आते हैं जिनमें बीच का क्षेत्र काला और किनारियाँ भूरी होती हैं (चित्र 28 2)। बीज झुर्रीदार और विवर्णित या रंगहीन हो जाते हैं।

चित्र 28.2 : धान की पत्ती का भूरा या तिल-जैसे चकत्ते वाला रोग।

**रोग चक्र** : प्राथमिक या पहला संक्रमण (इनफेक्शन) बहुत उग्र होता है जब बोने के मौसम में भूमि का तापमान $26^\circ$ सेन्टीग्रेड से नीचे गिर जाता है। प्रयोगों से पता चला है कि रोगजनक बीज में करीब एक साल यानी बोआई के अगले मौसम तक जीवनक्षम बना रहता है। वातोढ़ या हवा द्वारा उड़ने वाले कोनीडियम द्वितीयक या बाद वाला संक्रमण करने में महत्वपूर्ण रोल अदा करते हैं। फसल की प्रौढ़ावस्था में यह द्वितीयक संक्रमण रोग को उग्र रूप से फैला सकता है। लम्बी वर्षा ऋतु की अपेक्षा समय-समय पर नियमित बौछारों के साथ अधिक नमी से कोनीडियम अधिक उत्पन्न होते हैं और उनका बिखराव भी अच्छा होता है। कोनीडियम पानी की उपस्थिति मे $20^\circ$ से लेकर $35^\circ$ सेंटीग्रेड पर संक्रमण करते हैं। प्रकाश की अपेक्षा अंधेरे में संक्रमण बड़ी तेजी से होता है। पौधे "बूट" या पुष्पन-अवस्था में अधिक संवेदनशील होते हैं। आपेक्षिक आर्द्रता (नमी) में अचानक वृद्धि, रोज के तापमान के परास (रेंज) में गिरावट और बदली का बने रहना ऐसे कारक हैं जिनसे रोग के फैलने में सहायता पहुँचती है।

**नियंत्रण** : बीजों को बोने से पहले वजन की दृष्टि से 1 : 300 भागों में कार्ब-पारदीय (ऑर्गेनो-मरक्यूरियल) पदार्थों से उपचारित किया जाता है। 10 मिनट तक $55^\circ$ सेन्टीग्रेड पर गरम पानी में बीजों का उपचार भी वातोढ़ संक्रमण को कम करने में काफी प्रभावकारी रहता है। वातोढ़ प्रकार के द्वितीयक संक्रमण को 5 : 5 : 50 के अनुपात में बोर्डो मिश्रण या डायाथेन जेड-78 को, मौसम के दौरान, दो या तीन बार छिड़क कर रोका जा सकता है। भारत में टी-141 (उड़ीसा), सी० ओ० 20 (मद्रास) और टी० 498-2 ए (बिहार) सरीखी रोधी किस्मों से अच्छे परिणाम प्राप्त हो रहे हैं।

## (2) बाजरे का अर्गट रोग

### रोगजनक : क्लेवीसेप्स माइक्रोसेफैला (कवक)

**लक्षण** : रोग तब स्पष्ट होता है जब स्पाइक के स्पाइक्लेटों से हल्के गुलाबी या शहद जैसे रंग के तरल (हनीड्यू) की नन्हीं बूँदें रिसने लगती हैं। बाद में रिसने वाली ये बूँदें काले रंग की हो जाती हैं और बाल में कई काले व चिपचिपे धब्बे एक साथ दिखलाई

देने लगते हैं। अन्त में तुषों (ग्लूम्स) के बीच में कई छोटे व गहरे भूरे रंग के स्क्लेरोशियम बाहर निकलते हुए दिखलाई देने लगते हैं। इससे बीज का बनना संदमित हो सकता है।

**रोग-चक्र** : संक्रमण फूल से होता है। रोग का फैलाव कोनीडियमों के माध्यम से होता है जो 13 महीनों तक जीवनक्षम बने रहते है और अंडाशय (ओवरी) पर आक्रमण करते हैं।

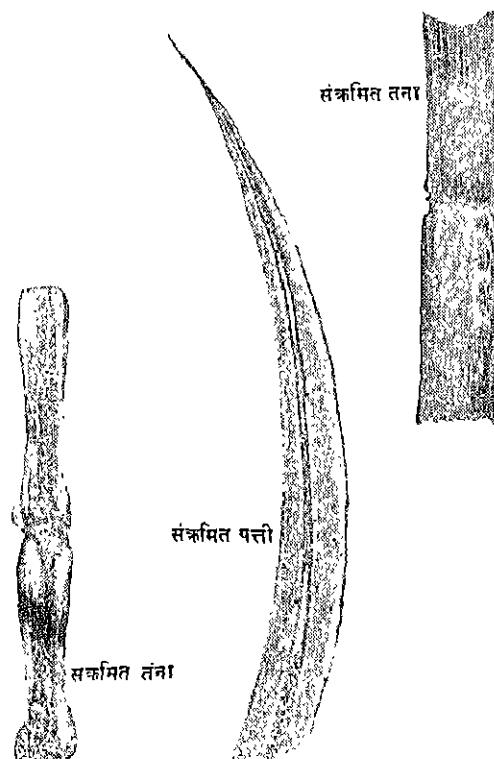
**नियंत्रण** : यह रोग बीजोढ़ है। इसलिए अर्गट से मुक्त बीजों को ही इस्तेमाल करना चाहिए। बीजों को 20% सोडियम क्लोराइड (नमक) या 30% पोटेशियम क्लोराइड के विलयन में डुबोना चाहिए। रोगी बीज तैरते रहेंगे और तन्दुरुस्त बीज डूब जाएंगे। फिर डूब जाने वाले तन्दुरुस्त बीजों को पानी में धोकर ही खेत में बोया जाता है।

### (3) गन्ने का लाल विगलन रोग (रेड रॉट) रोगजनक : कालेटोटाइकम फैल्केटम (कवक)।

भारत में यह रोग भारी क्षति पहुँचाता है, विशेषकर पूर्वी उत्तर प्रदेश और बिहार में।

**लक्षण** : गन्ने के संक्रमित फटे भागों से एल्कोहलीय गंध आने लगती है और सफेद अनुप्रस्थ पट्टियों वाले लाल ऊतक दिखाई देते हैं। पत्तियाँ झड़ जाती हैं और गन्ने पर झुर्रियाँ पड़ जाती हैं और झुर्रीदार पपड़ी में काले धब्बे दिखाई देते हैं (चित्र 28 3)।

**रोग-चक्र** : रोग बीज के लिए गन्ने के कटे भागों से फैलता है। द्वितीयक संक्रमण कोनीडियमों द्वारा होता है, जो पत्ती की मध्य शिरा (मिड-रिब) के विक्षतों (लेजन्स) या घाव वाले भागों में बहुतायत से उत्पन्न होते हैं।

**नियंत्रण** : बीज के लिए तन्दुरुस्त बीजी भागों का इस्तेमाल किया जाना चाहिए। पौधे की रोधी किस्मों को उगाया जाना चाहिए।

चित्र 28.3 : गन्ने का लाल विगलन (रेड रौट)।

### (4) धान का जीवाणु-अंगमारी (बैक्टीरियल ब्लाइट) रोगजनक : जैंथोमोनास ओरिजी (जीवाणु : बैक्टीरियम)

धान का जीवाणु-अंगमारी भारत में जापान की ताइचुंग सरीखी अधिक उपज वाली किस्मों के साथ ही प्रविष्ट हुआ। जापान में यह रोग इस सदी के प्रारम्भ से ही अच्छी तरह से ज्ञात था। पिछले दशक के दौरान भारत में इससे भारी नुकसान पहुँचा है।

**लक्षण** : यह रोग जुलाई से अक्टूबर तक होता है और पत्ती की एक या दोनों सतहों पर हल्के हरे या हरे पीले विक्षतों (लेजन्स) या क्षत भागों के रूप में दिखलाई पड़ता है। ये विक्षत फैलकर तथा एक दूसरे से मिलकर लम्बी लहरदार धारियाँ बना लेते हैं। बाद में ये हल्की

पीली धारियाँ पुआल वाले पीले रंग की हो जाती है जिनमें लहरदार भूरे किनारे होते है। रोगी पत्ती बहुधा ऊपरी सिरे से नीचे की ओर सूखती चली जाती है। संक्रमण की उग्रता में सारा खेत ऐसा लगता है मानो जला हुआ हो।

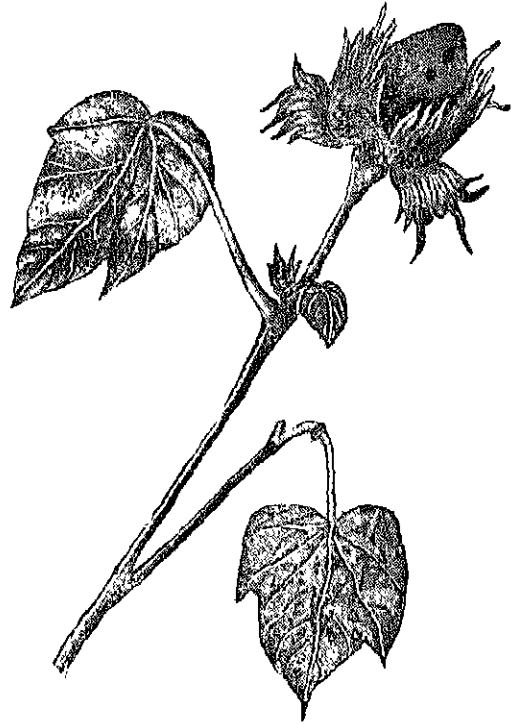
**रोग-चक्र** : रोगजनक अन्दर और बाहर से बीज, ठूंठों और पुआल में जीवित रहता है और प्राथमिक निवेश द्रव्य (इनॉकुलम) का स्रोत होता है जो संवहन ऊतकों में बढ़ता रहता है। रोगी पत्तियों में निकला जीवाणविक (बैक्टीरियल) रिसाव द्वितीयक निवेश द्रव्य (इनॉकुलम) का बहुत अच्छा स्रोत होता है और इसका बिखराव वर्षा की बौछारों, कीटों, सिचाई के पानी आदि से आसानी से हो जाता है।

**नियंत्रण** : बीजों को 0.025% ऐग्रिमाइसिन के विलयन और 0.05% क्लेदनीय सेरीसॅन के मिश्रण में 12 घंटे तक भिगोया जाता है। फिर इन्हे 30 मिनट तक 52°-54° सेन्टीग्रेड तक गरम पानी में रखा जाता है और उसके बाद ही बोया जाता है। खेतों में जल प्रबन्ध उत्तम प्रकार से होना चाहिए।

## (5) कपास का कृष्ण शाखा अथवा कोणीय पर्ण चकत्ता रोग

### रोगजनक : जैंथोमोनास माल्वासिएरम (जीवाणु)

यह कपास का एक भयानक जीवाणु रोग है। यह दुनिया के कपास उगाने वाले सभी प्रमुख प्रदेशों में होता है और पहले पहल मद्रास में सन् 1918 में पाया गया था।

**लक्षण** : जीवाणु (बैक्टीरियम) तरुण और पुराने दोनों प्रकार के पौधों के वायवीय या भूमि के ऊपर के सभी भागों पर आक्रमण करता है। रोग का बिल्कुल आरम्भिक लक्षण अंकुरित होने वाले बीजों के बीजपत्रों (कौटीलेडन्स) में दिखाई देता है। पत्तियों में जलसिक्त छोटे चकत्ते दिखलाई देते हैं, जो पुराने होने पर गहरे भूरे रंग के और हल्के लाल या हल्के बैंगनी किनारे वाले हो जाते हैं। तने पर भी काले रंग के लम्बे विक्षत (लेजन) दिखलाई देते हैं (चित्र 28.4)।

चित्र 28.4 : कपास का कोणीय पर्ण चकत्ता या कृष्ण शाखा रोग।

**रोग-चक्र** : यह रोग बीजोढ़ होता है। प्राथमिक संक्रमण मुख्य रूप से बीज से होता है जो जीवाणु या बैक्टीरियम को रोओं में या अपने अन्दर चिकने पुंज के रूप में धारण दिए रहता है। भूमि की सतह पर पड़े संक्रमित कपास के गोले, पत्तियाँ और टहनियाँ भी रोग फैलाने में महत्वपूर्ण योग देती हैं। पत्तियों में संक्रमण मुख्यत: रंध्रों (स्टोमेटा) के द्वारा होता है। रोग का द्वितीयक संक्रमण वर्षा की बौछारों और ओस से होता है।

**नियंत्रण** : बीजों को सांद्र या तेज गंधक के अम्ल (सल्फ्यूरिक एसिड—$H_2SO_4$) द्वारा 10-15 मिनट तक उपचारित किया जाता है। फिर अम्ल को धोने के लिए इन्हें पानी में खूब धोया जाता है। अंत में बीजों को एग्रोसन जी एन, सेरीसन द्वारा 2 से लेकर 2.5 ग्राम प्रति कि० ग्रा० बीजों की दर से उपचारित किया जाता है। जीवाणु

(बैक्टीरियम) बीज में करीब एक साल तक ही रहता है इसलिए यह सुझाव दिया जाता है कि बोने के पहले बीजों को दो साल तक भंडार में रखना चाहिए।

## (ख) मृदोढ़ (सॉयल बोर्न) रोग

मृदोढ़ या मिट्टी से फैलने वाले कुछ रोग ये है: (6) बाजरे का हरित बाली (ग्रीन इयर) रोग, (7) बाजरे का कंड (स्मट), (8) मूँगफली का टिक्का रोग, (9) टमाटर का मूल-ग्रंथि या जड़ों पर गाँठ वाला रोग। चूंकि प्राथमिक निवेश द्रव्य (इनॉकुलम) का स्रोत भूमि ही है इसलिए नियंत्रण उपायों में भूमि का प्रबन्ध व उपचार होना ही चाहिए। मूँगफली के प्ररूपी या सामान्य टिक्का रोग का चक्र चित्र 28.5 में दिखलाया गया है।

चित्र 28.5 : मूँगफली के टिक्का रोग का चक्र (मृदोढ़ – सॉयल बोर्न)।

### (6) बाजरे का हरित बाली रोग

**रोगजनक : स्क्लेरोस्पोरा ग्रैमिनीकोला** (कवक)

बाजरा या पर्ल मिलैट आपेक्षिक रूप से निकृष्ट भूमि में उगता है और राजस्थान, गुजरात, महाराष्ट्र, पंजाब तथा उत्तर प्रदेश के शुष्क और अर्द्ध शुष्क क्षेत्रों की मुख्य फसल के रूप में उगाया जाता है। इसकी खेती बहुत सरल रीति से होती है और यह भारतीय खाद्य अर्थ व्यवस्था का आधार है। भारत के सभी बाजरा उगाने वाले क्षेत्रों का प्रमुख रोग हरित बाली रोग है। राजस्थान, पंजाब और दिल्ली में ही 40 से 50% वार्षिक हानि आँकी जाती है। भारत में इस रोग की खोज बटलर ने की थी।

लक्षण : रोगी या ग्रस्त पत्तियाँ सफेद हो जाती हैं और बाद में इनकी निचली सतह पर बीजाणु धानियों (स्पोरेंजिया) की भूरी सफेद मृदुरोमिल (डाउनी) रचनाएँ

चित्र 28.6 : बाजरे का हरित बाली रोग।

दिखलाई देने लगती है। बाली या पुष्पक्रम (इनफ्लोरेसेंस) पूरे या आंशिक रूप में छोटे, व्यावर्तित (ट्विस्टेड) तथा हरी पत्ती जैसी रचनाओं के श्लथ मुडक (लूज हेड) में रूपान्तरित हो जाता है (चित्र 28.6)।

**रोग-चक्र** : यह मृदोढ़ रोग है। पौधे के कचरे के साथ जमीन पर गिरने वाले निषिक्तांड (ऊस्पोर) अनुकूल परिस्थितियों में अंकुरण करते हैं। द्वितीयक संक्रमण करने वाली बीजाणुधानियाँ (स्पोरेंजिया) हवा, पानी और कीटों द्वारा ले जाई जाती हैं।

**नियंत्रण** : रोग के नियंत्रण की दिशा में अभी अधिक कार्य नहीं किया गया है। संक्रमण कम करने के लिए संक्रमित बीजों को ऐग्रोसन जी० एन० से उपचारित करने का सुझाव दिया जाता है। गरम पानी का उपचार भी लाभकारी होता है। खेती के लिए बाजरे की एच० बी० आई० सरीखी रोग रोधी किस्म की सिफारिश की जाती है।

## (7) बाजरे का कंड (स्मट) रोग

### रोगजनक : टोलिपोस्पोरियम पेनीसिलेरियाई

**लक्षण** : ग्रस्त दाने बाल से अलग होकर तुषों (ग्लूम) से बाहर नाशपाती की आकृति की रचनाओं में साफ-साफ झलकने लगते हैं। स्तम्भ चमकीला हरा या चाकलेटी भूरा होता है और जब यह पुराना होता है तो भद्दे काले रंग का बन जाता है जिसमें अन्दर बन्द बीजाणुओं (स्पोर) का पुंज रंग में गहरा भूरा या काला होता है।

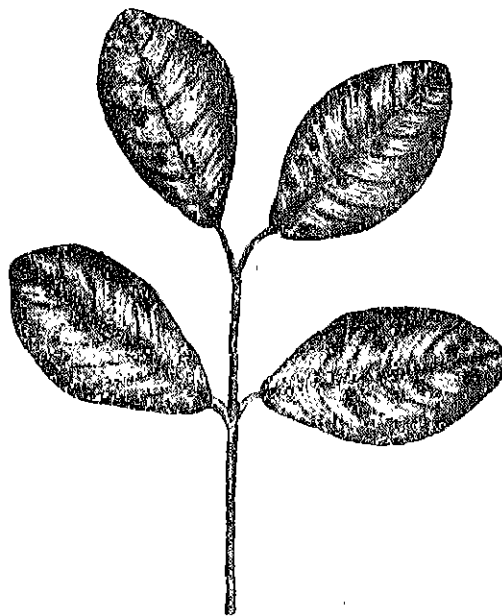
**रोग-चक्र** : पौधे मृदोढ़ बीजाणुओं द्वारा पुष्पन अवस्था पर संक्रमित होते हैं। टेल्यूटो बीजाणुओं (टेल्यूटो-स्पोर) द्वारा होने वाला द्वितीयक संक्रमण रोग को फसल में फैला देता है।

**नियंत्रण** : संक्रमित या रोगी पौधों को जला दिया जाना चाहिए और रोगरोधी किस्में उगाई जानी चाहिए।

## (8) मूँगफली का टिक्का रोग

### रोगजनक : सर्कोस्पोरा पर्सोनैटा

भयानक प्रकार से होने वाला मूँगफली का पर्ण चकत्ता या पत्ती के धब्बे वाला रोग सारे भारत में पाया जाता है। आम और बोलचाल की भाषा में इसे टिक्का रोग कहते हैं।

**लक्षण** : पत्ती की दोनों सतहों पर 4 से 10 मिमी० व्यास वाले कई ऊतकक्षयी (नेक्रोटिक) गोल चकत्ते या धब्बे दिखलाई देते हैं। कभी-कभी परिपक्व होने पर इन धब्बों के चारों ओर पीले रंग का एक घेरा भी हो सकता है (चित्र 28·7)।

चित्र 28.7 : मूँगफली का टिक्का रोग।

**रोग चक्र** : यह रोग हर साल कोनीडियमों के द्वारा फैलता है, जो भूमि में फल के खोल या छिलकों के भीतर या पौधे के कचरे में पड़े रहते हैं।

**नियंत्रण** : बोर्डो मिश्रण (4 : 4 : 50), डायथेन जेड-78 (0.2%) और डायथेन एम-45 सरीखे कुछ

कवकनाशियों का, रोग नियंत्रण के लिए इस्तेमाल किया जाता है। रोग मैगनीशियम की कमी के कारण फैलता है। इसलिए भूमि में मैगनीशियम वाले उर्वरकों का प्रयोग किया जाना चाहिए।

### (9) टमाटर का मूल-ग्रंथि या जड़ों की गाँठ वाला रोग (रूट नॉट)

**रोगजनक : मिलॉयडोजाइन हैप्ला**

यह एक सूत्रकृमि है, जो टमाटर के पौधों की जड़ों में परजीवी बनकर रहता है।

**लक्षण** : इस सूत्रकृमि के संक्रमण से पौधे की वृद्धि कम हो जाती है, अचानक ग्लानि (विल्टिंग) होने लगती है और जड़ों में पिटिकाएँ (गॉल) बनने लगती हैं जिसका नतीजा होता है उनमें गाँठों का पड़ जाना। डिम्भक (लार्वा) जड़ की मज्जा (पिथ) में प्रविष्ट होकर उसकी वृद्धि रोक देते हैं और उधर वल्कुट (कार्टेक्स) की कोशिकाएँ काफी बड़े आकार की हो जाती है (चित्र 28.8)।

चित्र 28.8 : टमाटर का मूल-ग्रंथि रोग (जड़ों पर गाँठें)।

**रोग-चक्र** : *मादा सूत्रकृमि और डिम्भक भूमि और पौधे के कचरे में जीवित रहते हैं। ये ही जड़ों को संक्रमित करते हैं।* मादा अनिषेकजनन (पार्थेनोजेनेसिस) की रीति से जनन करती है।

**नियंत्रण** : सूत्रकृमियों का जैविक नियंत्रण खेत में **टैगेटीज** (गेंदा) वंश के पौधे लगाने से हो जाता है। **टैगेटीज** वंश के पौधों की जड़ों का सूत्रकृमियों पर *आविषालु (टॉक्सिक) यानी विषैला प्रभाव पड़ता है।* टमाटर की जड़ों के अवशिष्ट नष्ट किए जाते हैं और भूमि में धूमकों (फ्यूमिगेन्ट) का प्रयोग किया जाता है। गर्मियों में दो या तीन बार हल चलाने से सूत्रकृमि के डिम्भक नष्ट हो जाते हैं।

## (ग) वालोढ़ (एयर बोर्न) रोग

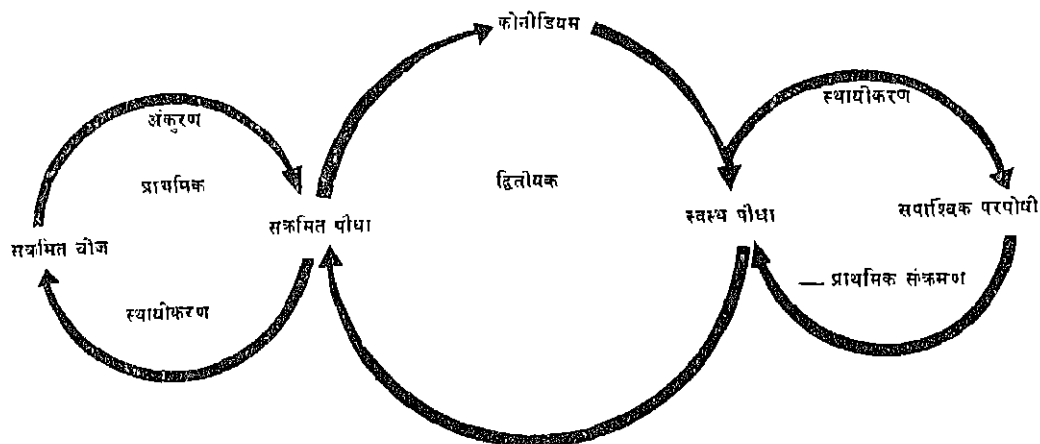
हवा में विद्यमान प्राथमिक निवेश द्रव्य (इनॉकुलम) के माध्यम से हर साल फैलने वाले रोग ये हैं :

*(10) धान का प्रध्वंस (ब्लास्ट), (11) गेहूँ का* किट्ट (रस्ट), तथा (12) कॉफी-किट्ट। नियंत्रण की सामान्य विधि है रोधी किस्मों तथा कवकनाशियों (फंगिसाइड) का इस्तेमाल। चित्र 28.9 में सामान्य जीवन-चक्र का नमूना दिया गया है।

### (10) धान का प्रध्वंस (ब्लास्ट)

**रोगजनक : पाइरीकुलेरिया ओरिज़ी (कवक)**

धान के पौधे का यह महत्वपूर्ण रोग, सारी दुनिया में पाया जाता है। यह पूरे भारत में भी पाया जाता है।

**लक्षण** : पत्तियों पर तर्कु (तकुवे) के आकार के विक्षत (लेज़न) प्रकट हो जाते हैं। ये धब्बे बीच में राख के रंग के और किनारों पर भूरे रंग के होते हैं। उग्र संक्रमण में पौधे नवोद्भिद् (सीडलिंग) वाली अवस्था में ही मुरझा जाते हैं। बाकी में गाँठें या पर्ण-संधियाँ (नोड) काली हो जाती हैं और जोड़ों पर टूट जाती हैं। गर्दन या बाली के नीचे वाले भाग पर

चित्र 28.9 : धान के प्रध्वंस (ब्लास्ट) रोग का जीवन-चक्र (वातोढ़—एयर बोर्न)।

चित्र 28.10 : धान का प्रध्वंस (ब्लास्ट) रोग। पौधे के शरीर के विभिन्न क्षेत्रों में रोग के लक्षण दिखलाए गए हैं।

आक्रमण होने पर बाली खेत में झड़ जाती है। दाने रीते ही रह जाते हैं और भूसेदार हो जाते हैं (चित्र 28.10)।

**रोग-चक्र** : प्रकृति में संक्रमण का उद्भव अभी भी साफ तौर से ज्ञात नहीं है। पहाड़ों में यह कवक पूरे जाड़े भर संक्रमित पुआल और पौधे के अन्य प्रकार के कचरे में जीवनक्षम बना रहता है और इस तरह रोग चक्र को चलाता है। लेकिन मदानों में, गरमियों के पूरे मौसम में पौधों के भागों अथवा भूमि में इसके जीवित रहने के मौके बहुत कम होते हैं। यह अभी ठीक ठीक मालूम नहीं है कि मैदानों में एक मौसम से दूसरे मौसम में रोग-चक्र कैसे चलता है। रोगजनक के प्रसार और बिखराव के सबसे महत्वपूर्ण साधन हैं वातोढ़ कोनीडियम। यह बिखराव उन बीजों, पुआल और कोनीडियमों से भी हो सकता है जो सिंचाई वाले पानी में गिरते हैं। केन्द्रीय धान अनुसंधान संस्थान (सेन्ट्रल राइस रिसर्च इन्स्टिट्यूट सी०आर०आर०आई०), कटक में किए गए अनुसंधानों से पता चला है कि करीब एक हफ्ते तक रात का तापमान 20° से 25° सेन्टीग्रेड और आपेक्षिक आर्द्रता (नमी) 90% या इससे ऊपर रहे तो रोग के शुरू होने की ये आदर्श दशाएँ हैं। वृद्धि की संवेदनशील प्रावस्थाएँ (फेज़ेज) हैं या तो नवोद्भिद अवस्था या दौजी अवस्था (टिलरिंग स्टेज) या फूल निकलने वाली अवस्था।

**नियंत्रण** : फसल पर ब्लास्टिसिडिन नामक प्रति-जैविक (ऐन्टीबायोटिक) का छिड़काव किया जाता है। खेती के लिए जिन रोधी किस्मों की सिफारिश की जाती है वे हैं—सी॰ओ॰ 4 (Co4), सी॰ओ॰ 25(Co 25), टी॰ 141 (T 141)।

## (11) गेहूँ के किट्ट (रस्ट)

### रोगजनक : (तने के काले किट्ट का) पक्सीनिया, ग्रेमिनिस ट्रिटिसी (कवक)

भारत में होने वाले अन्य रोगों की अपेक्षा गेहूँ के किट्ट रोग पर सबसे अधिक कार्य हुआ है, और इनका विस्तृत अध्ययन के॰ सी॰ मेहता द्वारा किया गया है। गेहूँ के किट्ट निम्नलिखित हैं :

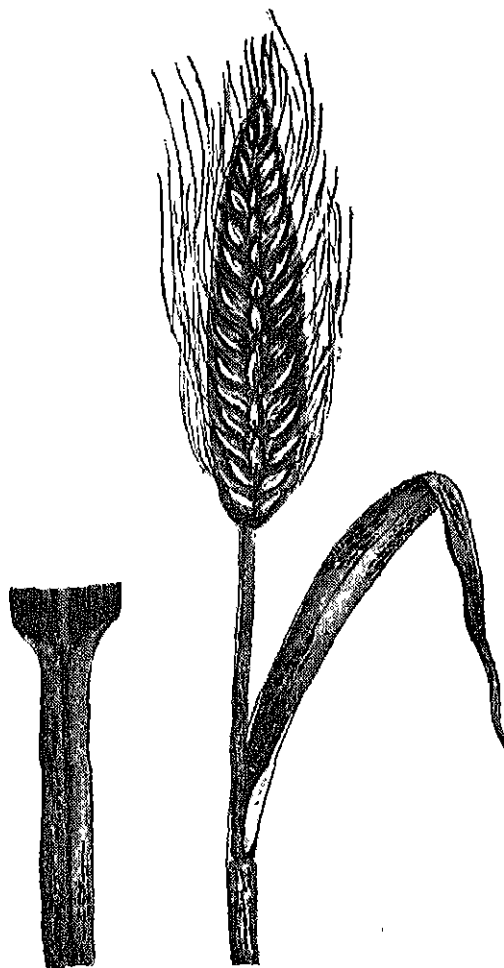
(क) काला स्तम्भ किट्ट (ब्लैक स्टेम रस्ट)।

(ख) पत्ती का भूरा किट्ट (ब्राउन लीफ रस्ट)।

(ग) पीली धारियों वाला किट्ट (यलो स्ट्राइप रस्ट)।

यहाँ पर काले किट्ट रोग का विस्तार में वर्णन किया जा रहा है।

**लक्षण** : यूरीडियमपुंजों (यूरीडोसोरी) के भूरे स्फोट या फफोले जैसी रचनाएँ पत्तियों, पर्णच्छदों और तने पर दिखलाई देने लगती हैं। ये स्फोट (पुस्ट्यूल) या फफोले - जैसी रचनाएँ वृद्धि करके और मिलके बड़े गहरे भूरे विक्षत (लेज़न) बना लेती हैं। पौधे की लम्बाई कम हो जाती है और कम तलशाखन (टिलरिंग) के कारण दाने पतले व झुर्रीदार होते हैं (चित्र 28.11)।

**रोग-चक्र** : प्राथमिक संक्रमण के स्रोत हैं यूरीडो-बीजाणु (यूरीडोस्पोर) जो पहाड़ों पर उगाई जाने वाली गेहूँ की फसल पर साल भर अलैंगिक (एसेक्सुअल) रूप से बनते हैं। हवा द्वारा उड़ाए जाने वाले ये यूरीडो-बीजाणु मैदानों में पहुँच कर गेहूँ की फसलों का संक्रमण करते हैं। इस कवक को लैंगिक (सैक्सुअल) जीवन-चक्र पूरा करने के लिए एकान्तर (आल्टर्नेट) परपोषी पौधे **बरबेरिस वल्गेरिस** की आवश्यकता पड़ती है। लेकिन

चित्र 28.11 : गेहूँ के तने का काला किट्ट (रस्ट)। पत्ती की सतह और पर्णच्छद (लीफ शीथ) पर रोग के लक्षण दिखलाई दे रहे हैं।

पौधे की यह जाति भारत में नहीं पाई जाती, इसलिए कवक का जीवन-चक्र पूरा नहीं हो पाता। अतः संक्रमण मुख्य रूप से यूरीडोबीजाणुओं के द्वारा ही होता है।

**नियंत्रण** : इसके लिए भारत में किट्ट रोधी (रस्ट रेसिस्टेन्ट) किस्में उगाई जाती हैं।

### (12) कॉफी किट्ट

**रोगजनक: हेमीलेइया वेस्ट्राफिक्स (कवक)।**

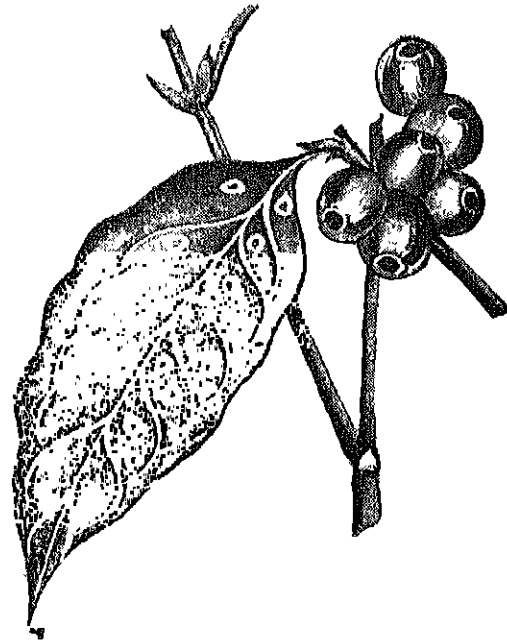
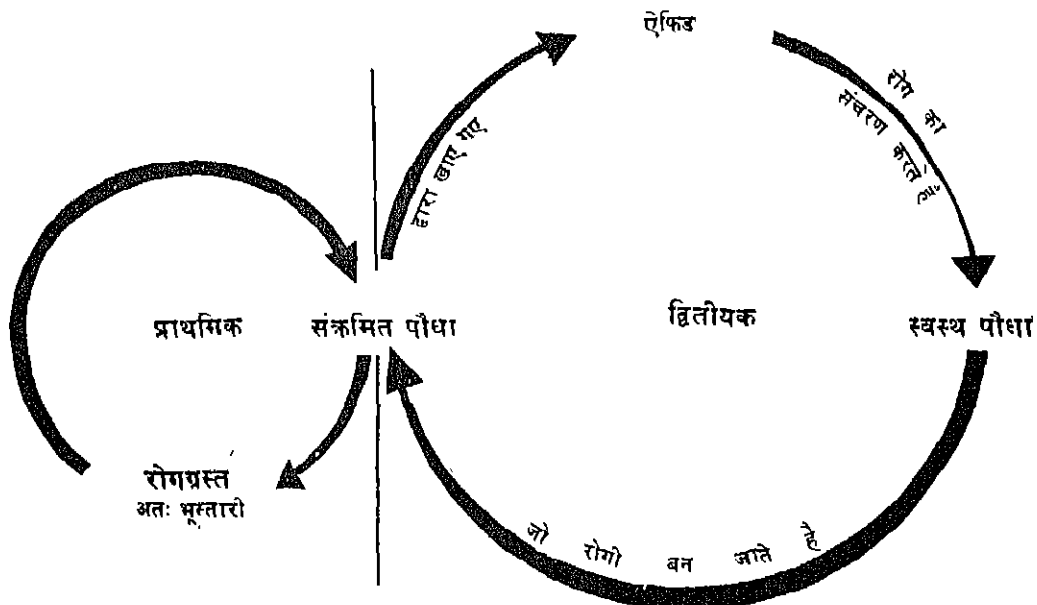
हेमीलेइया वेस्ट्राफिक्स द्वारा होने वाला किट्ट दक्षिण भारत की अरेबिका कॉफी का बड़ा भयानक रोग है।

**लक्षण :** पत्तियों की सतहों पर बीजाणुओं (स्पोर) सहित नारंगी पीले धब्बों के साथ-साथ ऊपरी सतह पर सूखे भूरे धब्बे भी दिखलाई देते हैं। संक्रमण की उग्रता में पत्तियाँ झड़ जाती हैं (चित्र 28.12)।

**नियंत्रण :** विभिन्न किट्टों (रस्टों) के प्रति रोधी किस्मों वाले विभेद (स्ट्रेन) विकसित करके और इस रोग का नाश करके हमारे देश ने काफी अधिक प्रगति की है। ताँबे के कवकनाशियों (फंगिसाइड) का भी बहुतायत से प्रयोग होता है। मंजरी या फूलों की वृष्टि के एक महीने बाद पत्तियों की निचली सतह पर बोर्डो मिश्रण (2: 2: 50) का छिड़काव किया जा सकता है।

## (घ) पौधे के भागों द्वारा फैलने वाले रोग

कुछ रोग हर साल पौधे के भागों या कीटों के द्वारा संचरित होते हैं। इनके प्रसिद्ध उदाहरण ये हैं :

(13) चाय का फफोला अंगमारी, (14) केले का गुच्छित चूड (रोग), (15) आलू मोजेक, और

चित्र 28.12 : कॉफी किट्ट (रस्ट), पत्ती की सतह पर रोग के लक्षण।

चित्र 28.13 : केले का गुच्छित चूड (बंची टॉप) का रोग चक्र। (कीट और पौधों के भाग)।

(16) आम की कुरचना । पौधों में विषाणुओं (वाइरसों) वाले रोगों का संचरण कीटों के माध्यम से होता है । केले के गुच्छित चूड का रोग चक्र (विषाणविक—वाइरल) चित्र 28.13 में दिखाया गया है ।

### (13) चाय का फफोला अंगमारी (ब्लिस्टर ब्लाइट)

#### रोगजनक : एक्सोबेसीडियम वेक्सैन्स

**लक्षण** : पत्तियों पर छोटे पीले धब्बे बन जाते हैं । पत्ती की ऊपरी सतह में एक उथला गर्त (गड्ढा) बन जाता है और निचली सतह हरी-सफेद बन जाती है जिसमें बीजाणु (स्पोर) होते हैं (चित्र 28.14) ।

**रोग-चक्र** : यह रोगजनक अविकल्पी परजीवी(आब्लीगेट पैरासाइट)होता है और चूँकि चाय की फसल चिरस्थायी होती है और साल भर चलती है इसलिए निवेश द्रव्य (इनॉकुलम) पौधों में विशेष क्षेत्री (एन्डीमिक) रूप में बना रहता है ।

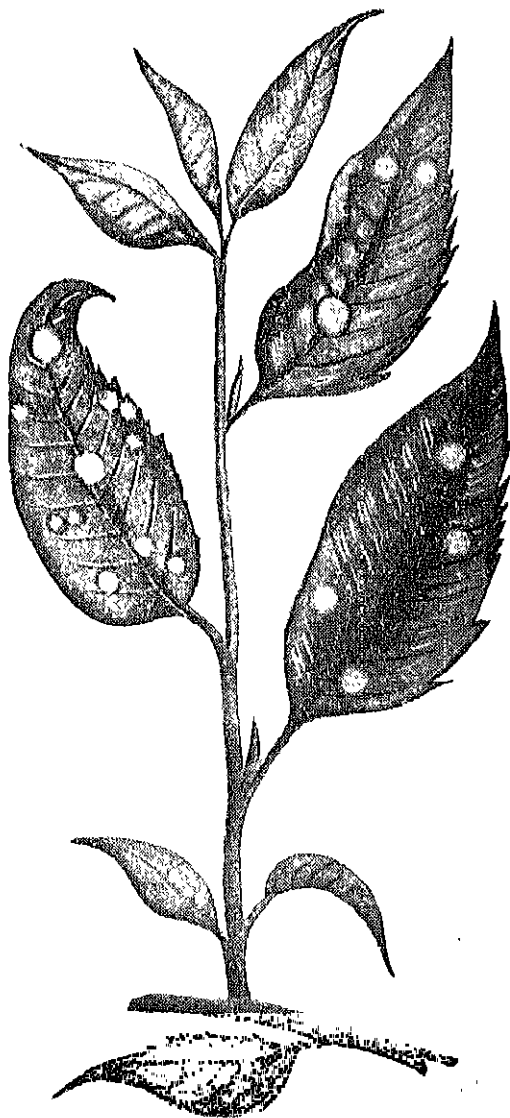
**नियंत्रण** : एक हफ्ते या दस दिन में एक बार पेरीनॉक्स (प्रति एकड़ 15 गैलन पानी में 6 औंस) फुहारना चाहिए या 4% क्यूप्रोसन (प्रति एकड़ 10 पौंड) की धूलि छिड़कनी चाहिए ।

### (14) केले का गुच्छित चूड (बंची टॉप) रोग

#### रोगजनक : केले का विषाणु (वाइरस)

केले का यह गुच्छित चूड रोग पूर्वी और दक्षिणी भारत में होता है ।

**लक्षण** : ग्रस्त या रोगी पौधे प्रायः कम बढ़ते हैं और सभी पत्तियाँ शीर्ष पर एक घने गुच्छे या स्तव(रोज़ेट) के रूप में परिवर्धित होती हैं । आरम्भिक प्रावस्था के दौरान मध्य शिरा (मिड रिब), डंठल और निचली सतह पर हरी धारियाँ दिखाई देने लगती हैं, और तनिक हरितहीनता (क्लोरोसिस) के साथ-साथ पत्तियाँ भी मुड़ जाती हैं ।

**रोग-चक्र** : संक्रमण रोगी अंतः भूस्तारियों (सकर) के रोपण से होता है । पौधे की वृद्धि के दौरान द्वितीयक संक्रमण एक एफिड (पेन्टालोनिया निग्रोनर्वोसा) के द्वारा होता है ।

चित्र 28.14 : चाय का फफोला अंगमारी (ब्लिस्टर ब्लाइट) ।

**नियंत्रण** : रोगी पौधों को उखाड़ कर जला दिया जाना चाहिए । रोपण या प्रसार करने के पहले सामग्री की अच्छी तरह से जाँच कर ली जानी चाहिए ।

### (15) आलू मोज़ेक (पोटेटो मोज़ेक)

#### रोगजनक : आलू विषाणु X(पोटेटो वाइरस X), या सोलेनम वाइरस I

आलू के कई विषाणविक (वाइरल) मोज़ेक रोग हैं। यहाँ हम एक गुप्त मोज़ेक (लेटेन्ट मोज़ेक) पैदा करने वाले आलू के विषाणु X यानी पोटेटो वाइरस X का वर्णन करेंगे।

**लक्षण** : इस रोग का विशेष लक्षण है पत्तियों का कर्बुरण (मौटलिंग) यानी चितकबरापन। पौधे की वृद्धि कम हो सकती है। पत्तियों और कंदों (ट्यूबर) में ऊतकक्षयी (नेक्रोटिक) चकत्ते भी दिखाई दे सकते हैं (चित्र 28.15)।

**रोग-चक्र** : खेत की दशाओं में रोग सम्पर्क के द्वारा फैलता है और विषाणु (वाइरस) रस के द्वारा संचरित होता है।

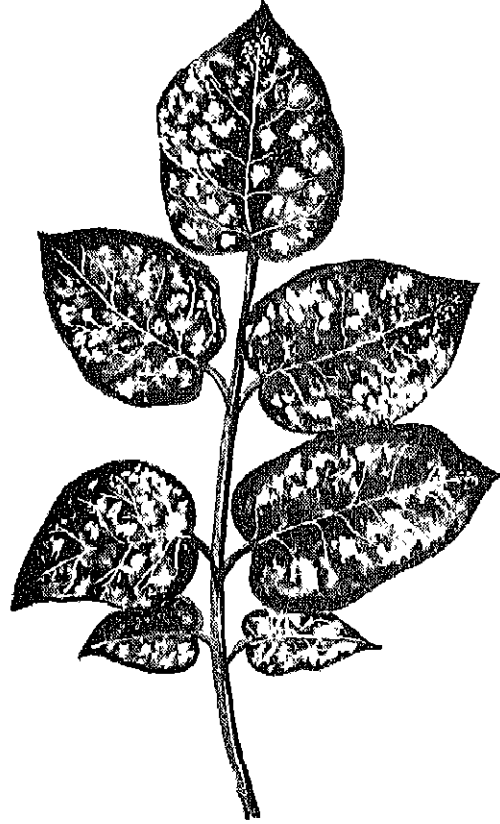
**नियंत्रण** : रोधी किस्में उगायी जानी चाहिए जो संक्रमण को काफी अधिक सीमा तक नष्ट कर देती हैं।

चित्र 28.15 : आलू का मोज़ेक रोग।

### (16) आम की कुरचना (मैंगो मैलफौर्मेशन)

#### रोगजनक : ईरियोफाइसीज़ स्पी० तथा टाइरोफैगस कैस्टेलानी (चिचड़ी—माइट)

आम के पौधे की कुरचना एक ऐसा विकार है जो उत्तरी भारत में बहुत होता है। यह कुरचना चिचड़ियों यानी माइटों (ईरियोफाइसीज़ स्पी०, टाइरोफैगस कैस्टेलानी) के ग्रसन के कारण उत्पन्न होती है जिससे वृद्धि अपसामान्य होती है।

**लक्षण** : संक्रमित पौधों की फूल वाली शाखाएँ शंकु बनाकर गुच्छे में हो जाती हैं। पुष्पावलि वृंत (पीडंकल) मोटा व गूदेदार तथा अधिक शाखाओं वाला हो जाता है। जननक्षम फूल दुर्लभ हो जाते हैं। सारा पुष्पक्रम (इनफ्लोरेसेन्स) काला पड़ जाता है। फल कभी बनते ही नहीं और फूलों के स्थान पर असंख्य छोटी पत्ती-जैसी संरचनाएँ उत्पन्न हो जाती हैं जिससे कूर्चीसम रोग (विचेज ब्रूम) का आभास होता है। पत्ती जैसी रचनाओं का प्रत्येक समूह कुरचित पुष्पक (फ्लोरेट) को चित्रित करता है।

**नियंत्रण** : ग्रसित या रोगी टहनियों का सुनियोजित प्रकार से निराकरण करने से रोग-प्रसार पर नियंत्रण रहता है। कीटनाशियों या इनसेक्टीसाइडों (बासुडिन, इकेटिन, सिस्टाउ आदि) को फुहारने से चिचड़ियों का नाश हो जाता है।

## अभ्यास

1. टमाटर के मूल-ग्रंथि या जड़ों की गाँठों वाले रोग को दर्शाने वाला चित्र बनाओ और इसका रोगजनक (पैथोजेन) बतलाओ। इस रोग का नियंत्रण कैसे होता है ?
2. किट्ट (रस्ट) क्या है ? गेहूँ के काले तने के किट्ट (ब्लैक स्टेम रस्ट) के लक्षणों का वर्णन करते हुए इसके नियंत्रण उपाय बताओ।
3. केवल नामांकित चित्रों की सहायता से निम्नलिखित के लक्षण दिखलाओ : धान का प्रध्वंस (ब्लास्ट) रोग, धान का जीवाणविक अंगमारी (बैक्टीरियल ब्लाइट), कॉफी किट्ट (रस्ट) और बाजरे का कंड रोग (स्मट)।

# अध्याय-29

# पौधों के पीड़क (पेस्ट)

पीड़क या पेस्ट वे प्राणी अथवा पौधे हैं जो खेती के पौधों या पौधों के उत्पादों को क्षति पहुँचाते हैं। मोटे तौर पर कह सकते हैं कि बोआई, कटाई भंडारण और उपभोग के बीच पीड़कों के कारण खेतों से प्राप्त होने वाली संभावित उपज का एक-तिहाई तो यूँ ही नष्ट हो जाता है। विश्व की आलू की औसत वार्षिक उपज 20 करोड़ टन आँकी जाती है। यदि इसके 4% का भी नुकसान हो तो इसका मतलब हुआ 80 लाख टन का नुकसान। अर्थव्यवस्था की हानि के अतिरिक्त, यह कितना बड़ा नुकसान है कि इतना कीमती भोजन बेकार चला जाता है। हमारे देश में विशेष रूप से धान और गेहूँ जैसी प्रमुख खाद्य फसलें संक्रमण के कारण केवल खेतों में ही नष्ट नहीं होतीं बल्कि भंडारों या अन्नागारों में कृंतक प्राणियों (रोडेन्ट) और संक्रमण द्वारा इनका उपभोग और/या नाश किया जाता है। इस तरह अन्न के प्रत्येक किलो के नुकसान या नाश के बजाय निश्चित ही है कि यदि नाश न होता तो किसी परिवार का भरण पोषण होता। इसलिए अपनी खेती के पौधों में सुधार का लाना ही महत्वपूर्ण नहीं है बल्कि इससे भी अधिक जरूरी यह है कि हमें पीड़कों से फसलों की रक्षा के लिए खेतों तथा संग्रहागारों (स्टोर हाउस) दोनों स्थानों पर सचेत और सावधान रहना पड़ेगा, और यह तभी संभव है जब हम विविध फसलों के विभिन्न पीड़कों की पूरी जानकारी हासिल कर लें। दूसरे शब्दों में अपनी फसलों की जानकारी ही पर्याप्त नहीं बल्कि उनके पीड़कों और उनके नियंत्रण-उपायों की जानकारी भी उतनी ही जरूरी है। पीड़कों को सामान्यतया निम्नलिखित प्रकार से वर्गीकृत किया जाता है :

(i) **संधिपाद (आर्थोपोड)** (संधिपाद अकशेरुकी—ज्वाइंटफूटेड इनवर्टिब्रेट)।

   (क) टिड्डे, इल्ली (कैटरपिलर), गंधी, बग, मक्खी, भृंग (बीटल), कपास गोलक शलभ, चिचड़िया, खपड़ा बीटल, धान का घुन, लाल धान्य भृंग, लघु धान्य बेधक (बोरर), दाल भृंग, ऐंगुमॉइस धान्य शलभ (मौथ), आदि कीट।

   (ख) केकड़े (क्रैब) सरीखे अन्य संधिपाद (आर्थोपोड) जो कीट नहीं हैं।

(ii) **मोलस्क—घोंघा** (स्नेल), कम्बु (स्लग)।

(iii) **स्तनी**—कृंतक (रोडेन्ट), बंदर, जंगली हाथी आदि।

(iv) **पक्षी**—कबूतर, तोता, गौरैया, कौआ।

## (i) संधिपाद (आर्थोपोड)

आर्थोपोड जुड़े पद वाले प्राणी हैं। इनमें टिड्डे, इल्लियाँ (कैटरपिलर), बग, मक्खी, भृंग (बीटल) आदि कीट आते हैं। ये कृषि, वनों और पशुधन को भीषण

क्षति पहुँचाते हैं। ये कीट तने में वेधन करके अन्दर पहुंच जाते हैं, फलों व फूलों को खाते हैं, अन्य रोगजनक (पैथोजेन) जीवों के लिए प्रवेश मार्ग बनाते है, आविपालु यानी विषैले पदार्थों का उत्सर्जन करते हैं और विपाणु या वाइरस रोगों का संचरण करते हैं।

कीटों का नियंत्रण कीटनाशियों (इनसेक्टीसाइड) को फुहार कर किया जाता है। अशन या भोजन करते समय भोजन के साथ कीटनाशियों का पीड़कों (पेस्ट) के शरीर में शोषण हो जाता है या विष का सम्पर्क अथवा स्पर्श होते ही इन पर ऐसा असर पड़ता है कि ये मर जाते हैं।

चिचड़िया (माइट) अधिकांशतया शाकीय पौधों पर आक्रमण करती हैं। ये पत्तियों से रस चूसती हैं। संक्रमित पत्तियों पर शुरू में सफेद चकत्ते दिखलाई देते हैं जो मृत्यु तक भूरे रंग के हो जाते हैं। पत्ती की निचली सतह पर जाल बुन लिया जाता है, जिसके अन्दर अंडे दिए जाते हैं और फिर अंडों से डिम्भक (लार्वा) निकलते हैं।

चिचड़ियों का नियंत्रण डी० एन० ओ० सी० (DNOC) सम्पाक वाली फुहारों और कार्बफासफोरस (आर्गनोफासफोरस) यौगिकों, ऐकेरस नाशियों (ऐकेरिसाइडों) के द्वारा होता है। ये कीट पौधे के भागों का भोजन के रूप में उपयोग करते हैं, अन्दर प्रवेश कर जाते हैं और आविषालु (टौक्सिक) या विषैले पदार्थों का स्रावण करते हैं। डिम्भक (लार्वा) पत्तियों का आहार करते हैं।

केकड़े भूमि तल पर तरुण पौधों को काटकर धान की फसल को भीषण क्षति पहुँचाते हैं। इनको हाथ से पकड़कर या पात्रों में चारा (बेट) रखके पाश बनाकर या बिलों में 50% डी० डी० टी० भात के साथ मिलाकर रखने से इनका नियंत्रण किया जाता है।

### (ii) मोलस्क या मृदुकवची (घोंघे और कंबु या स्लग)

पौधों की सतहों पर श्लेष्माभ पथ (स्लाइम ट्रेक) घोंघों की विशेषता है। ये प्राणी रेतन (रेस्पिंग) प्रकार की भोजन विधि से क्षति पहुँचाते हैं। ये मुलायम पत्तियों, नवोद्भिदों (सीडलिंग), मुलायम छाल और झड़े हुए फलों का आहार करते हैं। हाथ से चुन और पकड़कर तथा मेटेल्डीहाइड सरीखे मोलस्कनाशियों (मोलस्किसाइड) द्वारा इनका नियंत्रण और नाश किया जाता है। मेटेल्डीहाइड को आटे के चोकर के साथ पाश (बेट) वाले चारे के रूप में भी प्रयुक्त किया जा सकता है। घोंघों पर कॉस्टिक उर्वरकों के अनुप्रयोग से नियंत्रण रहता है।

### (iii) स्तनी (चूहे, खरगोश, जंगली हाथी आदि)

चूहे (रैट) और मूषक (माउस) हमारी फसलों को खेत और भंडारण दोनों में काफी क्षति पहुँचाते हैं। ये अन्न का उपभोग तो करते ही हैं साथ ही भंडारित उत्पादों का प्रदूषण (पाल्युशन) भी कर देते हैं। ये कई रोगों के वाहक भी होते हैं। इन प्राणियों की फुरती वाली गति और छिप-छिपाव वाले तरीकों से इनको नियंत्रित करना कठिन हो जाता है। जिंक फास्फाइड को भोजन के साथ मिलाकर और विलोमक या चारे के रूप में रखने पर चूहों को मारा जा सकता है। बंदर और लंगूर, विशेष रूप से, झुंड में सब्जी और फलों के बगीचों पर आक्रमण करते हैं। खरगोश, हिरन और जंगली हाथी भी समूह में पहुँचकर फसलों को क्षति पहुँचाते हैं।

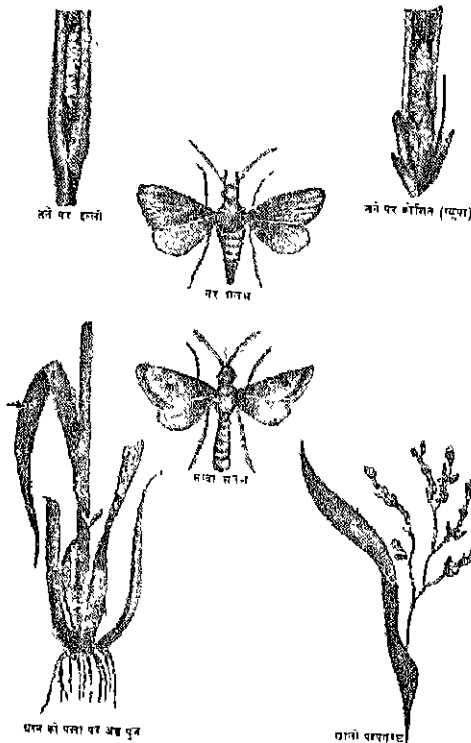
### (iv) पक्षी

घर की गौरैया, तोते, कबूतर और कौवे सरीखे कई पक्षी धान्यों या बीजों, फलों आदि का आहार करते हैं। पाश (ट्रैप) द्वारा इनको पकड़कर, इनके छिपने के स्थानों को मिट्टी से बन्द कर, घोंसलों से अंडे निकाल कर, कागभगोड़ों का प्रयोग कर और भगाने के लिए मरी चिड़ियों का प्रदर्शन कर इनका नियंत्रण किया जाता है। लेकिन यह भी ध्यान देने योग्य बात है कि इनमें से कुछ पक्षी कीटों को खाकर उनकी आबादी को कम रखते हैं। इसलिए इनके नियंत्रण के तरीकों को अपनाने से पहले उन पर विवेक से सोच-विचार कर लेना चाहिए। गौरैयों और कौवों को स्ट्रिकनिन, आर्सेनिक और फास-

फोरस से विषाक्त किए गए मांस या अंडों के चारे से नियंत्रित किया जा सकता है। ये विष अन्य प्राणियों पर भी असर दिखलाते हैं। इसलिए इन विलोमकों के प्रयोग में काफी सावधानी बरतनी चाहिए।

## कुछ महत्वपूर्ण पादप-पीड़क (प्लान्ट पेस्ट)

### (1) धान का तना वेधक (स्टेम बोरर) (शीनोबियस इनसर्टुलस)

यह धान का बड़ा महत्वपूर्ण पीड़क है (चित्र 29.1)। हल्के पीले रंग के इस शलभ के अगले पंखों में काले धब्बे होते हैं। इस कीट का डिम्भक (लार्वा) धान के पौधों के तने को वेधकर अन्दर घुस जाता है। बीच का प्ररोह या तना मुरझाकर अन्दर के भाग को नष्ट कर देता है।

चित्र 29.1 : धान का तना वेधक (स्टेम बोरर)।

**नियंत्रण** : अंडों को नष्ट करने के लिए फसल के बाद ठूँठों को नष्ट कर देना चाहिए। प्रतिरोपण (ट्रान्स-प्लान्टेशन) के पहले नवोद्भिदों को डी॰डी॰टी॰ के 0.1 प्रतिशत विलम्बन में उपचारित करना चाहिए। फिर खेत में पकी फसल को 0.025% पैराथायोन या 0.08% एल्ड्रिन द्वारा प्रति एकड़ 270 से लेकर 360 लिटर की दर से फुहारा जाना चाहिए।

### (2) धान का टिड्डा या धान का भूरा पादप बोंका (हाइरोग्लिफस बनियन)

यह कीट धान की फसल की पत्तियों और मुलायम दानों को खाता है। शिशु या अर्भक (निम्फ) तथा प्रौढ़ दोनों ही पौधों को खाते हैं।

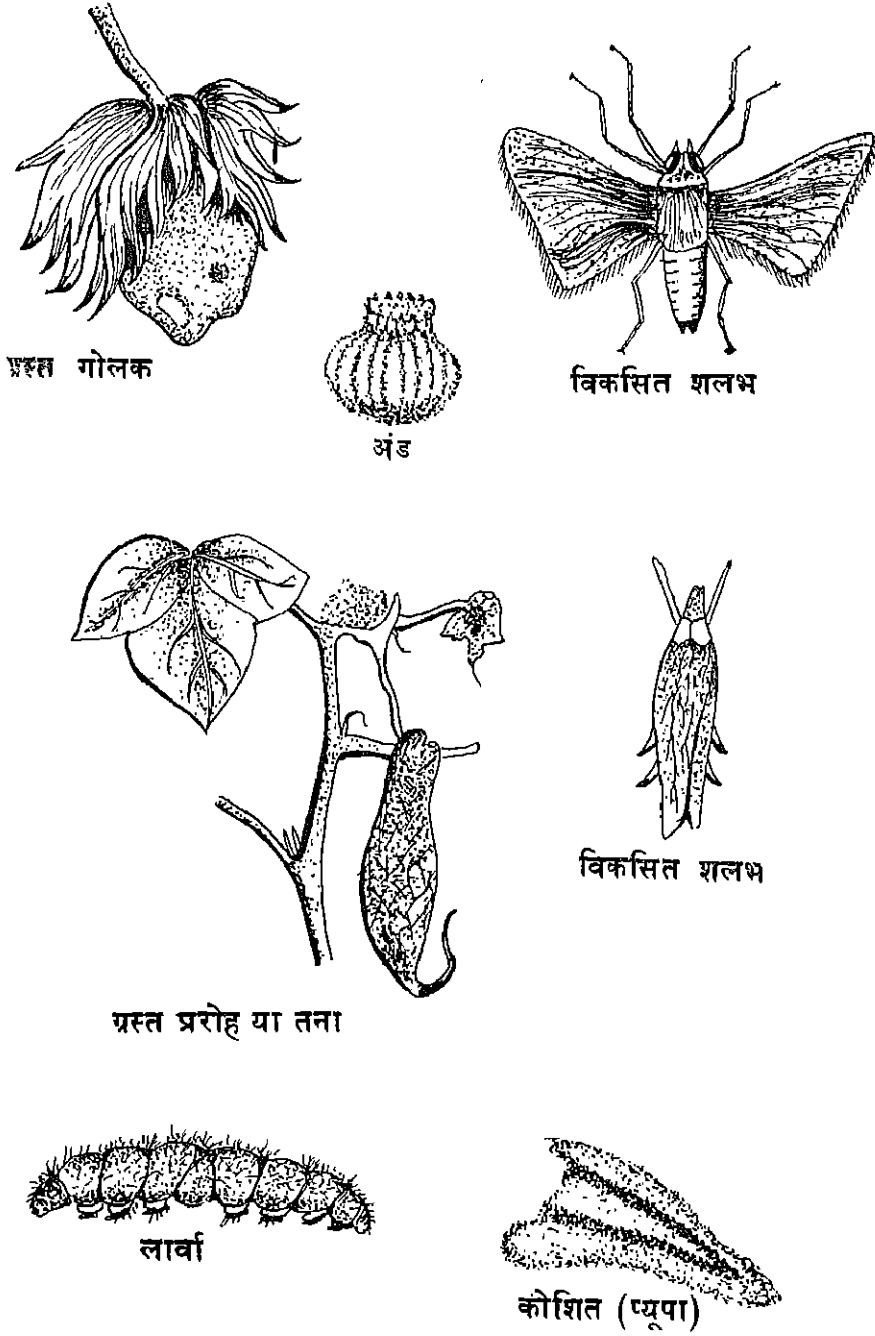
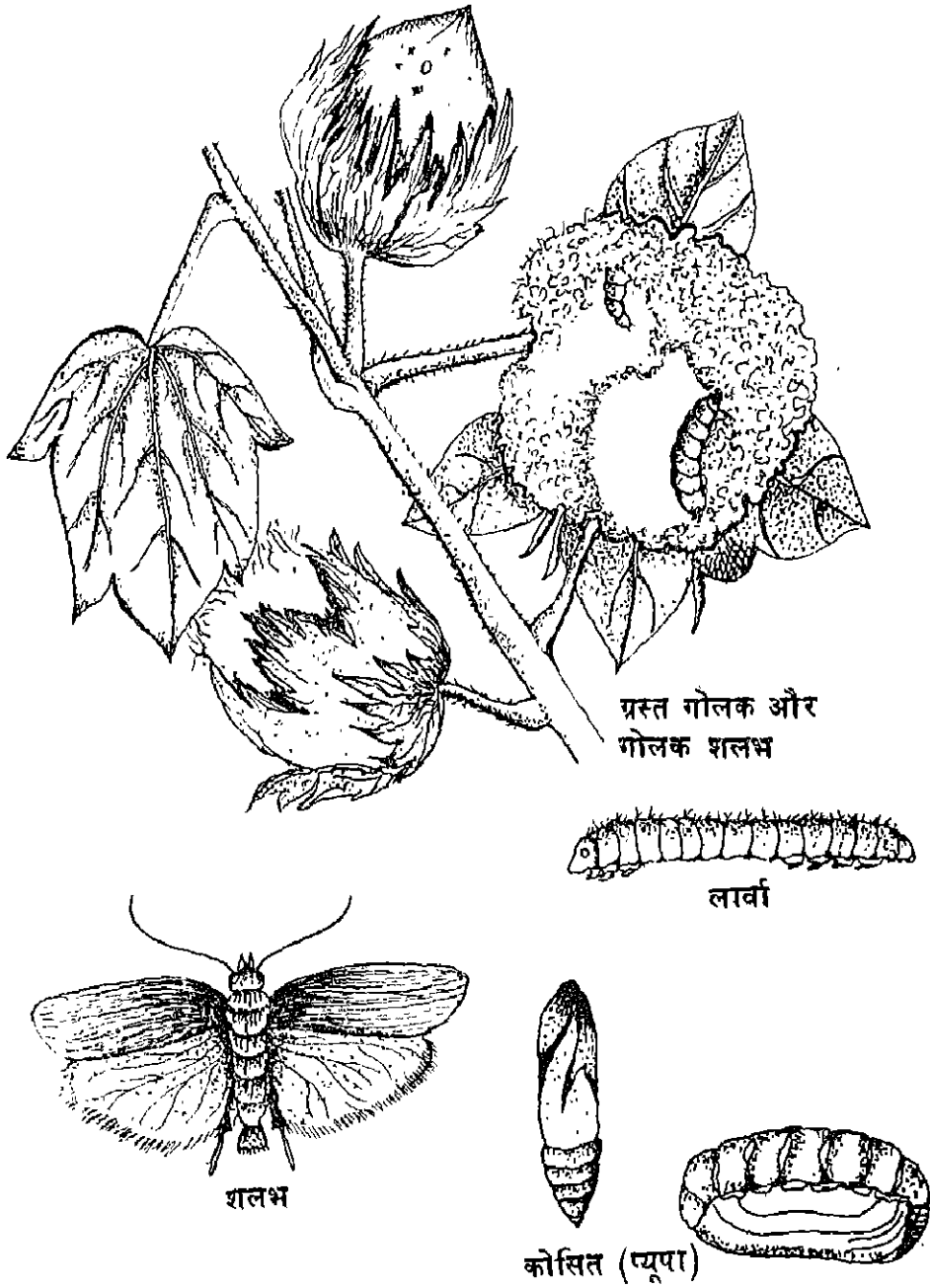
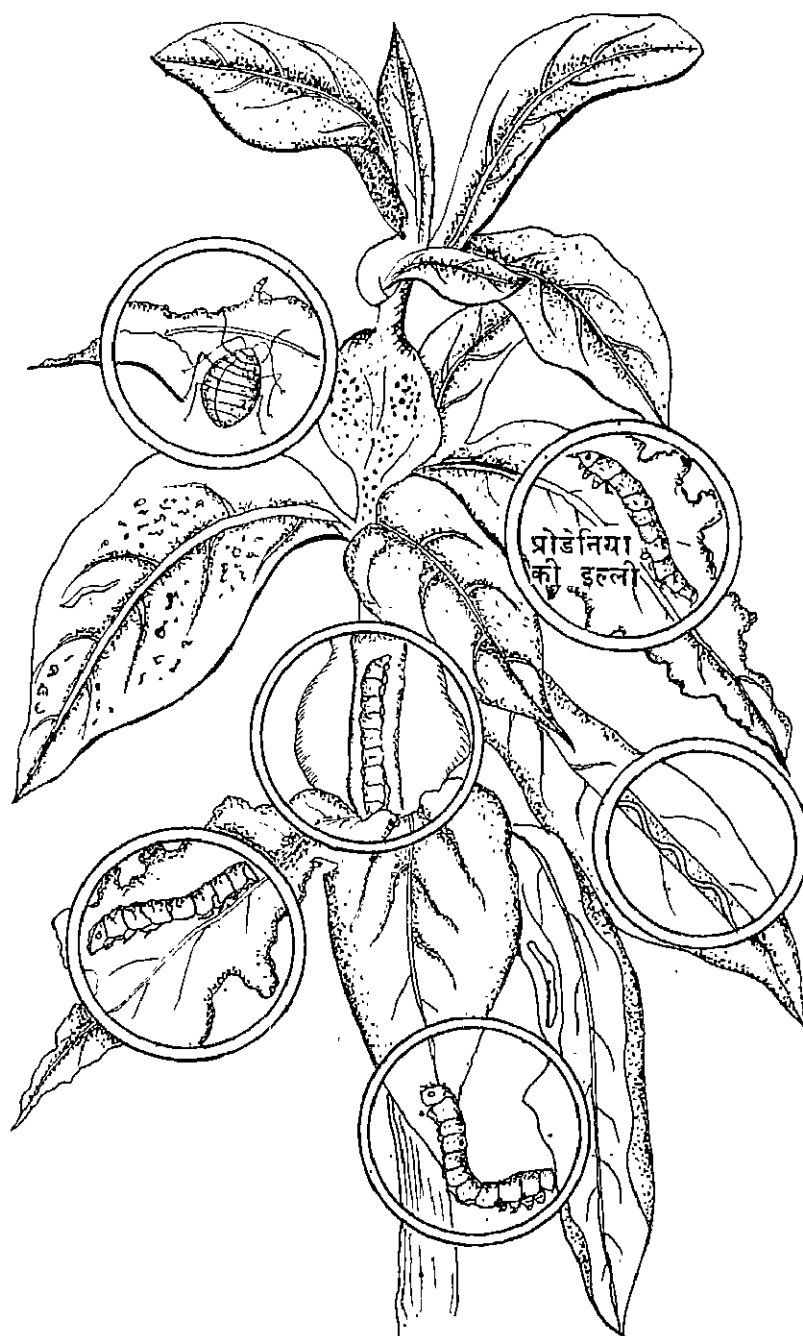
**नियंत्रण** : प्रत्येक फसल के बाद गहरा हल चलाकर इनका नियंत्रण किया जा सकता है। प्रति एकड़ 90 लिटर की दर से पौधों पर 5 से 10% बी॰ एच॰ सी॰ की धूलि भी छिड़कनी चाहिए। प्रति एकड़ 270 से 360 लिटर की दर से 0.02% एल्ड्रिन फुहारने से पीड़कों पर नियंत्रण रहता है।

### (3) गंधी बग या धान का बग (लेप्टोकोराइजा वेरीकौर्निस)

प्रौढ़ बग छरहरा हल्का भूरा, 14 मिमी॰ लम्बा और बारीक टाँगों वाला होता है। यह मुलायम दानों से दूधिया रस चूसता है। कभी-कभी तो इसके द्वारा फसल पूरी तरह से ही नष्ट कर दी जाती है।

**नियंत्रण** : पौधों को इस तरह हिलाया जाना चाहिए कि तरुण या नन्हें अर्भक (निम्फ) नीचे पानी में गिर जाएँ। बी॰एच॰सी॰ (बेंजीन हेक्साक्लोराइड) को 5% तक तनुकृत या हल्का करने और प्रति एकड़ 5.5 से 6.8 किग्रा॰ डालने से शिशुओं या अर्भकों का नाश हो जाता है।

### (4) कपास का चित्तीदार गोलक शलभ (स्पॉटेड बॉलवर्म) (ईरियास फेबिया)

यह एक छोटी व गठे बदन की भूरी इल्ली (कैटर-पिलर) है जो आरम्भिक अवस्था में कपास के पौधे के

चित्र 29.2 : कपास का चित्तीदार गोलक शलभ (स्पॉटेड बॉल वर्म) ।

चित्र 29.3 : कपास का गुलाबी गोलक-शलभ (पिंक बॉल वर्म)।

चित्र 29.4 : तंबाकू के पीड़क और रोग।

ऊपरी प्ररोह या तने वाले भागों को वेध कर अन्दर पहुँच कर बाद मे गोलकों या गोलों में पहुँच जाती है (चित्र 29.2)। इससे प्ररोह या तने के ऊपरी भाग नीचे की ओर झुक जाते हैं और गोले झड़ जाते हैं। प्रौढ़ अवस्था में यह शलभ (मॉथ) फीका सफेद होता है जिसका पंख विस्तार यानी पंख का फैलाव 25 मिमी० होता है।

**नियंत्रण** : संक्रमित तने के भागों और गोलकों को नष्ट कर दिया जाना चाहिए। फसल के बाद सभी ठूँठों को अलग कर देना चाहिए। पन्द्रह दिन के अंतराल पर 0.03% एन्ड्रिन को प्रति एकड़ 350 से 450 लिटर की दर से फुहारना चाहिए।

### (5) कपास का गुलाबी गोलक शलभ (पिंक बॉल वर्म) (पेक्टिनोफोरा गोसिपिएला)

यह एक छोटे आकार का गहरा भूरा शलभ है, जिसके पंखों में भिन्न-भिन्न आकार के कई काले धब्बे होते है। इसके पंखों का विस्तार 12.5 मिमी० होता है। फीके या गहरे गुलाबी रंग की यह इल्ली गोलकों और बीजों को वेधकर अंदर पहुँच जाती है और फिर गोलकों के अन्दर ही यह कोशित या प्यूपा में बदल जाती है (चित्र 29 3)।

**नियंत्रण** : झड़ी हुई कलियों और गोलकों को अलग कर देना चाहिए। इस पीड़क के नियंत्रण के लिए 20% एन्ड्रिन या 0.2% फोलीथायोन की फुहार करनी चाहिए।

### (6) नारियल-इल्ली (कोकोनट कैटरपिलर) (निर्फेन्टिस सेरीनोपा)

यह नारियल का खतरनाक पीड़क है जो पश्चिम मे कुमारी अंतरीप से लेकर बम्बई तक और पूर्व में मद्रास से लेकर बंगाल तक के समुद्रतटीय क्षेत्रों में पाया जाता है। प्रौढ़ शलभ मध्यम आकार का होता है जिसके पंखों का विस्तार 20-25 मिमी० तक होता है। इल्ली हरे रंग की होती है जिसमें रोमों का विरल आवरण होता है। यह पत्तियों को खाती है। ग्रस्त पौधों को दूर से ही उनके प्रपर्णों (फ्रौन्ड) के झुलसे रूप से पहचाना जा सकता है।

**नियंत्रण** : ग्रस्त प्रपर्णों (फ्रौन्ड) को नष्ट किया जाना चाहिए। प्रति वृक्ष 4.5 से 9 लिटर की दर से 0.2% डी० डी० टी० फुहारा जाना चाहिए।

### (7) तंबाकू की इल्ली (टोबैको कैटरपिलर) (प्रोडेनिया लिटुरा)

यह मोटा व काला शलभ (मॉथ) है, जिसके अग्र या अगले पंखों में सफेद लहरदार निशान होते हैं (चित्र 29.4)। ये इल्लियाँ पत्तियाँ खाती हैं।

**नियंत्रण** : प्रति एकड़ 7 से 10 किग्रा० की दर से 10% बी०एच०सी०, 5% डी० डी०टी० या 2% पैराथायोन की धूलि का छिड़काव किया जाना चाहिए।

## धान और दालों के गोदाम वाले पीड़क

### (8) खपड़ा भृंग (ट्रोगोडर्मा ग्रैनेरियम)

यह भूरा व अंडाकार भृंग या बीटल है, जो आकार में 2.5 मि०मी० लम्बा होता है (चित्र 29.5)। इसके

चित्र 29.5 : खपड़ा भृंग (बीटल) के डिम्भक।

भृंगक (ग्रब) यानी डिम्भक भूरे सफेद होते हैं जिनके शरीर के चारों ओर लाल भूरे रंग के रोमों के गुच्छे होते हैं। ये धान्यों तथा दालों को खाते हैं। फिर भी गोदाम में इनका आक्रमण ऊपर की परत तक ही सीमित रहता है।

### (9) धान का घुन (राइस वीविल) (कैलेन्ड्रा ओरिज़ी)

2.5 से०मी० लम्बाई वाला यह छोटा जंतु (चित्र 29.6) लाल भूरे रंग का होता है और पूरे विश्व में पाया जाता है। धान के साथ-साथ इसके प्रौढ़ और भृंगक (ग्रब) सभी धान्यों और ज्वार-बाजरे का आहार करते हैं।

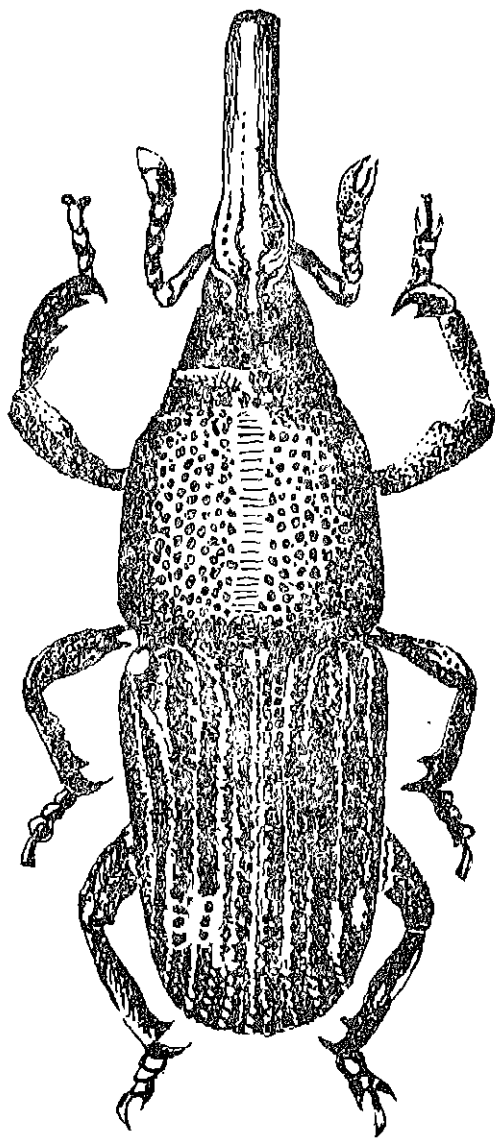
### (10) लाल धान्य भृंग (रेड ग्रेन बीटल) (ट्राइबोलियम कैस्टेनियम)

लाल भूरा 1.5 मि०मी० लम्बा यह भृंग या इसके फीके पीले रंग के भृंगक (ग्रब) या शिशु धान्यों, ज्वार-बाजरे, दालों, मूँगफली, मेवों, आदि के खुले दानों और आटे पर पोषण प्राप्त करते हैं। इस कीट को आटे का लाल भृंग (रस्ट रेड फ्लोर बीटल) भी कहा जाता है।

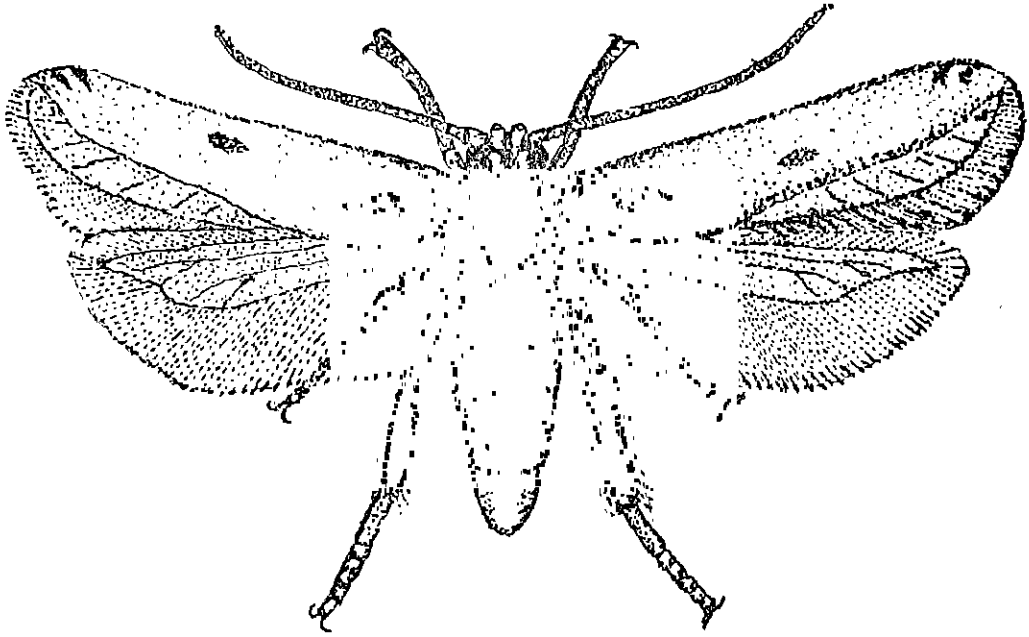
### (11) लघु धान्य वेधक (लेस्सर ग्रेन बोरर) (राइज़ोपर्था डोमनिका)

1.5 मि०मी० लम्बाई का यह भृंग (बीटल) रंग में काला या भूरा काला होता है जिसका गोलाकार सिर धान्यों, दालों और ज्वार-बाजरे के दाने में वेधन करके उनको नष्ट कर देता है। इन भृंगों के शिशु या भृंगक (ग्रब) सफेद रंग के होते हैं।

### (12) धान का शलभ (राइस मॉथ) (कॉरसिरा सेफेलोनिका)

यह गहरे धूसर रंग का शलभ है जो भंडार घरों और गोदामों में कहीं भी अंडे दे सकता है। ये अंडे पाँच दिन के अन्दर क्रीमी सफेद इल्लियों में फूट जाते है, जो दानों पर पोषण प्राप्त करती हैं और दानों में छेद कर देती हैं। इल्ली एक रेशमी जाल बुन लेती है जिसमें दाने आदि के टुकड़े भी लगे रहते हैं। यह शलभ (मॉथ) तिलहनों और मेवों पर भी आक्रमण करता है।

चित्र 29.6 : धान का प्रौढ़ घुन।

### (13) ऐंगमॉइस धान्य शलभ (ऐंगमॉइस ग्रेन मॉथ) (सिटोट्रोगा सीरिएलेला)

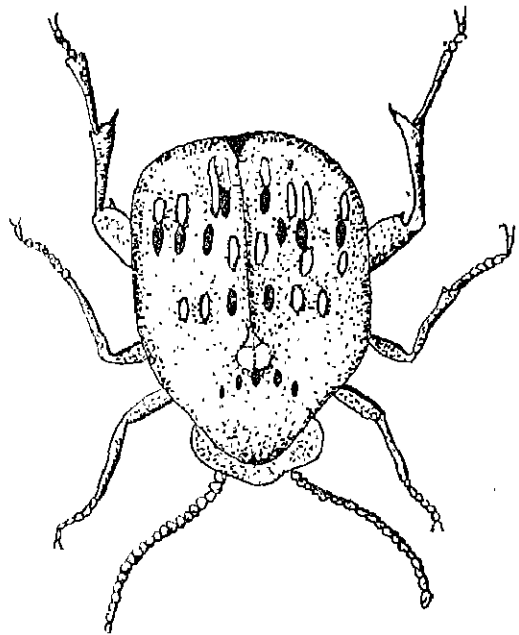
यह 12 मिमी० लम्बा व चमकदार बफ रंग का शलभ है, जिसमें नोकीले, बारीक व चौड़ी धारीदार पंख

चित्र 29.7 : ऐंगमॉइस धान्य शलभ (ग्रेन मॉथ)।

होते हैं (चित्र 29.7)। इल्ली धान्यों और ज्वार-बाजरे के दाने में वेधन करके उन्हें खोखला बना देती है। दाने की दरारों में मादा कई सौ अंडे देती है। यह बगैर कुटे धान्यों का एक महत्वपूर्ण शलभ पीड़क (मॉथ पेस्ट) है।

### (14) दाल भृंग (पल्स बीटल) (ब्रूकस स्पी०)

ब्रूकस वंश (जीनस) के कई भृंग (बीटल) ऐसे हैं जो चाकलेटी रंग के होते हैं (चित्र 29.8)। प्रौढ़ और शिशु या भृंगक (ग्रब) दाल की फलियों या दानों में वेधन करते हैं। इनमें से कुछ भृंग केवल भंडार घर में ही प्रजनन करते हैं और बाकी खेतों में प्रजनन करके खड़ी फसलों को काफी अधिक क्षति पहुँचाते हैं।

ऊपर बताए गए पीड़कों के अलावा कई और भी पीड़क हैं जो भंडार घर और गोदामों के धान्यों को प्रत्यक्ष रूप से खाते हैं, जैसे चींटी, तिलचट्टा (काक्रोच), चूहे आदि।

**नियंत्रण :** भंडारण वाले पीड़कों को सामान्यतया सुसंवातित गोदामों में नियंत्रित किया जाता है। छत और

चित्र 29.8 : दाल-भृंग (ब्रूकस स्पी०)।

फर्श एक सार और चिकने होने चाहिए और उनके बीच में दरार व छेद नहीं होने चाहिए । दानों में दस प्रतिशत से अधिक नमी नहीं होनी चाहिए। एक गोदाम में केवल एक ही प्रकार का अन्न भरा रहना चाहिए। ऐसा प्रबन्ध रखना चाहिए कि बोरे दीवारों को न छुए। दीवाल और छत की सतहों पर 0.5 लिटर प्रति 100 वर्ग मीटर की दर से 0.5% लिन्डेन या मैलाथायोन को फुहारा जा सकता है।

## अभ्यास

1. पीड़क (पेस्ट) से क्या समझते हो? जिन पीड़कों का अध्ययन किया हो उनका वर्णन करो।
2. धान के महत्वपूर्ण पीड़कों के नाम बतलाओ। उनके द्वारा की गई क्षति और उनके नियंत्रण उपायों का वर्णन करो।
3. खाली स्थानों को भरो :
   (क) बंगाल का अकाल धान के......रोग के कारण हुआ ।
   (ख) केले का गुच्छित चूड रोग (बंची टॉप)...... के द्वारा होता है।
   (ग) खपड़ा भृंग (बीटल) एक......पीड़क है।
4. भंडारण के पीड़कों के नियंत्रण की क्या सामान्य विधियाँ हैं? कृन्तकों (रोडेन्ट) का नियंत्रण हम किस प्रकार करते हैं जो कि भंडार के धान्यों को खाते हैं?
5. भंडारण के निम्नलिखित पीड़कों की पहचान वाले लक्षणों का वर्णन करो :
   (i) धान का घुन।
   (ii) ऐंगमॉइस धान्य शलभ (ग्रेन मॉथ)।
   (iii) दाल भृंग (बीटल)।
6 निम्नलिखित पर संक्षिप्त टिप्पणी लिखो :
   (i) धान का तना-वेधक (स्टेम बोरर)।
   (*ii*) *धान का गंधी बग।*
   (iii) कपास का चित्तीदार गोलक शलभ (स्पॉटेड बॉल वर्म)।
   (iv) नारियल-इल्ली (कोकोनट कैटरपिलर)।

# अध्याय-30

# मानव की सेवा में वन

मानव जब से इस ग्रह पर प्रकट हुआ है पौधे, विशेष कर पेड़, तभी से उसके साथी रहे हैं। अपने भोजन के निमित्त प्राणियों का शिकार करने के लिए वह घने जंगलों में रहता रहा है। जंगल के अंग्रेजी पर्याय 'फौरेस्ट' (लेटिन, फौरिस– आउट साइड यानी बाहर) का अर्थ है गाँवों के घेरे और सीमा के बाहर की भूमि, जो वृक्षों और क्षुपों के बन्द चंदोवे से ढकी रहती है। अंग्रेजी का 'फौरेस्ट' शब्द भारतीय शब्द 'जंगल' से इस बात में भिन्न है कि इसमें नियमित रूप से उगाए गए व व्यवस्थित पेड़ों का आभास होता है। दूसरे शब्दों में कहें तो कह सकते हैं कि फौरेस्ट या वन एक परितंत्र (इकोसिस्टम) है, जिसमें सजीव और अजीवित दोनों प्रकार के घटक होते है। भूमि के किसी भी क्षेत्र को, जिसमें विभिन्न युगों के वृक्षों की भिन्न-भिन्न जातियाँ निरन्तर संचित होती चली जाती है और जिसमें वर्तमान वातावरणी दशाओं में नियमित व्यवस्था करके उत्पादों की इष्टतम उपज प्राप्त की जाती है, वन की श्रेणी में रखा जा सकता है। ज्ञान-विज्ञान की वह शाखा, जिसमें अधिक से अधिक लाभ के लिए पेड़ों को वैज्ञानिक ढंग से लगाया, पाला-पोसा व देखा-भाला जाता है, वानिकी (फौरेस्ट्री) कहलाती है। यह वह विज्ञान है जिसमें प्रकृति का अध्ययन होता है और प्रकृति के अनुकूल कार्य किया जाता है न कि उसके साथ प्रतियोगिता।

सभ्यता के इतिहास पर एक दृष्टि डालने पर पता चलता है कि जंगल मानव के जीवन से घनिष्ठ रूप से जुड़े थे। जंगलों का संवर्धन और रक्षण ईसा से पूर्व चौथी शताब्दी के दौरान भी प्रचलित था। करीब 10,000 वर्ष पहले जंगलों में घूमते-घामते मानव ने पाया कि कुछ बीजों को भोजन के लिए उगाया जा सकता है। उसने इन बीजों को बोना और इनकी खेती करना आरम्भ कर दिया और इस तरह पेड़ों को काटते-गिराते कृषि के लिए अधिक से अधिक भूमि तैयार करने लगा। कुछ साल बाद जब भूमि कम उर्वर हो गई तो वह ऐसे ही अन्य वन्य क्षेत्रों की ओर अग्रसर हो गया और वहाँ भी उसने अपना यह आक्रमण दोहराया। कृषि के लिए पेड़ों को काटकर भूमि बढ़ाने की प्रक्रिया को तकनीकी भाषा में स्थानान्तरी कृषि (शिफ्टिंग ऐग्रीकलचर) कहते हैं, और यह प्रक्रिया कृषि से पूर्व की प्रक्रिया है। आर्य पशुचारणिक लोग थे इसलिए वे इन विधियों का प्रयोग करते थे लेकिन साथ ही उनमें आकर्षक दृश्यावली और परिवेश सम्बन्धी सौन्दर्य भावना भी विद्यमान थी। उस युग में मानव की आबादी बहुत कम थी और जंगल बहुतायत से पाये जाते थे। ज्यों-ज्यों मानव की जनसंख्या तेजी से बढ़ती गई त्यों-त्यों उसकी जरूरतें भी बढ़ती गई और यही कारण था कि उसने जंगलों का अधिक से अधिक सफाया करना शुरू कर दिया।

महाभारत काल में जंगल बहुत बड़े पैमाने पर नष्ट किए गए। इसीलिए हमारे पूर्वजों ने पेड़ों को काटना पाप कहा। इस तरह के कुछ उपायों को अपनाकर कुछ बुद्धिमान लोग पीपल, बरगद और बेल सरीखे कुछ वृक्षों को विलुप्त होने से बचा सके। सम्राट अशोक ने भी वनों का महत्व महसूस किया और महामार्गों पर लाभदायक वृक्षों को लगाने का आदेश दिया।

हाल के वर्षों में पिछले दो महायुद्धों के दौरान हमारे देश में जंगलों का नाश कुछ अधिक तेजी से हुआ, विशेषकर ब्रिटिश राज के अन्तर्गत, क्योंकि नौसेना के जहाजों और रेलवे के स्लीपरों के निर्माण के लिए लकड़ी को उपयोगी पाया गया। भारत में 1955 के वन नीति अधिनियम के बाद सरकार ने जंगलों को सुधारने के सुविचारित प्रयत्न किये, जो कारगर भी सिद्ध हुए लेकिन ये वन सम्पदा के नाश और रिक्तीकरण को नहीं बचा सके।

स्वतंत्रता के बाद, सन् 1950 में, हमारी सरकार ने 'वन महोत्सव' नाम का 'वृक्ष बचाओ और लगाओ' आन्दोलन छेड़ा। राष्ट्र के कल्याण में वनों की महत्वपूर्ण भूमिका के निमित्त सन् 1952 में राष्ट्रीय वन नीति का निर्धारण किया गया। इस नीति का मुख्य उद्देश्य था जंगलों की रक्षात्मक, उत्पादक और जैव सौन्दर्यपरक भूमिका। कार्य के आधार पर राष्ट्रीय नीति के अनुसार जंगलों का रक्षण वनों, राष्ट्रीय वनों और ग्राम वनों में वर्गीकरण किया गया। इस नीति का मुख्य उद्देश्य था—वृक्षीय वनों की स्थापना, दिनों-दिन बढ़ती आवश्यकता की पूर्ति के लिए पशुओं के चरने वाली भूमि, इमारती लकड़ी तथा जलाने वाली लकड़ी का आश्वासन। इसके अन्तर्गत यह भी चेतावनी दी गई कि वनों के नुकसान पर कृषि का विस्तार नहीं होना चाहिए क्योंकि ऐसा करने से भूमि तूफानों, अंधड़ों, हवा के गर्म झोंकों और जल अपरदन (इरोज़न) के प्रति अपने प्राकृतिक रक्षा उपायों से वंचित हो जाती है।

## हमारी वन सम्पदा

वन को एक उद्योग के रूप में लिया जाता है, जो राष्ट्र की अर्थव्यवस्था को मजबूत बनाने में महत्वपूर्ण रोल अदा करता है। हमारे नित्य प्रति के जीवन के अनेक उपयोगों के लिए वन कच्ची सामग्री प्रदान करते हैं और इस तरह प्रत्यक्ष या अप्रत्यक्ष रूप से हमारे उद्योगों को चलाते हैं। वन कहीं भी हो लेकिन वह भूमि की उर्वरता बनाए रखने, अपरदन रोकने और क्षेत्र विशेष की जलवायु के नियंत्रण में महत्वपूर्ण भूमिका निभाता है। यद्यपि यह निरन्तर नया किया जा सकने वाला प्राकृतिक साधन है लेकिन साथ ही यह समाप्त हो जाने वाला साधन भी है।

जलवायु, भू आकृति विज्ञान (फिज़ियोग्रैफी), भूमि, जल दशाओं तथा जीवीय समुदाय सरीखे कारकों की विविधता के कारण भारतीय वनों में बहुत अधिक किस्म के पेड़ होते हैं। विश्व के वनों के वर्गीकरण में भारतीय वनस्पति के प्रमुख भागों को मानसून व सूखे वनों, कँटीली झाड़ियों तथा सवाना में वर्गीकृत किया जाता है। पेड़ों की करीब 2500 जातियाँ हैं। हमारे वन देश के कुल भौगोलिक क्षेत्रफल के 17.2 प्रतिशत से अधिक भाग में फैले हुए हैं। लाभदायक जातियाँ पेड़ों की अन्य जातियों के साथ मिश्रित प्रकार से उगती हैं, सिवाय साल और चीड़ के। सारणी 30.1 में उपयोग में आने वाले वनों की कुल वार्षिक वृद्धि दिखलाई गई है जो अन्य देशों की तुलना में बहुत कम है। भारत में वनों के अन्तर्गत जो क्षेत्र है वह भी अन्य देशों की तुलना में कम है।

### सारणी 30.1

**भिन्न-भिन्न देशों में वन सम्बन्धी आधारभूत आँकड़े**

| | भारत | एशिया | ब्रिटेन | रूस | अमरीका |
|---|---|---|---|---|---|
| (क) कुल वन (लाख हेक्टेयर) | 560 | 5200 | 15 | 11.31 | 3160 |
| (ख) वन उपयोग में (लाख हेक्टेयर) | 456 | 2007 | 1352 | 4535 | 2137 |
| (ग) उपयोग में आने वाले वनों की वार्षिक वृद्धि (प्रति हेक्टेयर) | 0.5 | 2.6 | 3.5 | 1.9 | 3.0 |

भारतीय वनों को मोटे तौर पर दो वर्गों में बाँटा जा सकता है—चौड़ी पत्ती वाले सदापर्णी या सदाहरित वन (देवदार वन) और सुई जैसी या सूच्याकार पत्ती वाले पतझड़ी वन (बाँज या ओक वन), जिनमें कुछ ऋतुओं में पेड़ बिना पत्ती के हो जाते हैं।

वन की सम्पदा के उपयोग का अर्थ है लोगों की घरेलू माँगों की पूर्ति के लिए या उद्योगों के निमित्त कच्ची सामग्री की पूर्ति के लिए कई उत्पादों व पदार्थों का प्रत्यक्ष उत्पादन। वनों से प्राप्त होने वाले महत्वपूर्ण व्यापारिक उत्पाद हैं—लकड़ी, कागज, प्लाईवुड, राल (रेजिन), गोंद, लाख आदि।

वन के उत्पादों को निम्नलिखित प्रकार से वर्गीकृत किया जा सकता है :

(क) **मुख्य—लकड़ी।**

(ख) **गौण—प्राणी, सब्जियाँ और खनिज पदार्थ।**

इन पदार्थों या उत्पादों में से प्रत्येक की प्रकृति और उपयोग आदि के बारे में यहाँ पर संक्षेप में बतलाया जाएगा।

## काष्ठ या लकड़ी (वुड या टिम्बर)

प्रकाश संश्लेषण (फोटोसिंथेसिस) की आधारभूत प्रक्रिया में पौधे हवा और पानी का उपयोग करते हुए प्रकाश और पर्ण हरित (क्लोरोफिल) की सहायता से मंड और शर्करा बनाते हैं। ये काष्ठ के विभिन्न घटकों में परिवर्तित हो जाते हैं, जैसे कि लिग्निन और सेलुलोस में।

काष्ठ या लकड़ी कुछ विशेष प्रकार की कोशिकाओं से बनती है जिन्हें तंतु-कोशिका (फाइबर सेल) कहते हैं। इन कोशिकाओं में सेलुलोस नामक सफेद पदार्थ होता है जो लिग्निन के आवरण (कोट) से भूरा दिखलाई देने लगता है। लकड़ी को भारी और मजबूत बनाने का काम केवल तंतु-कोशिकाओं का ही है। लकड़ी प्रदान करने वाले वन के पेड़ों को मोटे तौर पर दृढ़ काष्ठ या दृढ़ दारु (हार्डवुड) और मृदु काष्ठ या मृदु दारु (सौफ्ट-वुड) में वर्गीकृत किया जा सकता है। भारतीय वनों के अधिकांश वृक्ष जैसे कि साल, सागौन, शीशम, यूकेलिप्टस, सफेदा आदि दृढ़ काष्ठ वाले वर्ग में और सूच्याकार पत्तियों वाले वृक्ष जैसे कि शंकुवृक्ष (कोनीफर), देवदार, चीड़, मृदुकाष्ठ वाले वर्ग में आते हैं।

सामान्य रूप से लकड़ी द्वारा ही मानव की बहुत सी आवश्यकताओं की पूर्ति होती है। इसके लाभकारी उपयोग के लिये इसकी संरचना और गुणों की जानकारी आवश्यक है। लकड़ी के उपयोग के अनुसार इसे औद्योगिक लकड़ी और ईंधन की लकड़ी के रूप में वर्गीकृत किया जा सकता है। भारतीय वनों के वृक्षों की 2000 से अधिक जातियाँ हमें लकड़ी देती हैं, जिसका अनेक प्रयोजनों के लिए उपयोग होता है। किसी विशेष प्रयोजन के लिए लकड़ी की उपयुक्तता का निर्धारण परीक्षण के बाद ही हो सकता है। उदाहरण के लिए, हवाई जहाजों के नोदकों (प्रोपेलर) के लिए **लिग्नम वाइटी** के बदले **अकेसिया चन्द्रा** की लकड़ी कड़ी और स्वस्नेहक पायी गयी। पुल, रेल के स्लीपर, सीमा स्तम्भ, संचारण खम्भे, प्लाई-वुड, औजारों के हत्थे, खिलौने, खेलकूद का सामान आदि बनाने में लकड़ी का उपयोग होता है। विशिष्ट रूप से लकड़ी के उपयोगों और उसकी उपयुक्तता का वर्णन सामान्यतया वनों के उपयोग सबन्धी पुस्तकों में किया जाता है।

कुल लकड़ी के 85 प्रतिशत से अधिक अंश को तो ईंधन के रूप में इस्तेमाल कर लिया जाता है। कैलोरी-मान और गर्मी प्रदान करने के दृष्टिकोण से लकड़ी को दो समूहों यानी अच्छे ईंधन और बुरे ईंधन में बाँटा जाता है।

## कागज

लकड़ी की रेशेदार व तंतुमय प्रकृति के कारण लुगदी, कागज और रेयन बनाने में इसका इस्तेमाल किया जाता है। करीब 4000 वर्ष पहले मिस्रवासियों ने नरकुल (रीड) से लिखने का कागज़ बनाया था और इसका नाम रखा था 'रीडपेपाइरस' जिससे कि कागज़ का अंग्रेजी पर्यायवाची 'पेपर' व्युत्पन्न हुआ है। सूच्याकार या सुई जैसी पत्तियों वाले फर, स्प्रूस आदि शंकुवृक्ष इसके लिए सबसे अधिक उपयुक्त कच्ची सामग्री प्रदान करते हैं क्योंकि इनमें लम्बे काष्ठ-रेशे होते हैं। कागज के लिए कच्ची सामग्री के रूप में बाँस का भी बहुतायत से

उपयोग किया जाता है। पिछली शताब्दी तक कागज बनाने में लकड़ी का ही प्रयोग किया जाता था। रसायनों में जब लकड़ी या बाँस की चिप्पियों को पकाया जाता है तो रेशों का गीला पुंज (लुगदी) प्राप्त हो जाता है, जिसे ताडित्र (बीटर) में फेर कर और फिर छानकर व सुखाकर इस्तेमाल में लाया जाता है।

किसी राष्ट्र की प्रगति प्रति व्यक्ति सभी प्रकार के कागज के प्रयोग के सूचकांक से आंकी जा सकती है। जैसा कि सारणी 30.2 में दिखलाया गया है भारत में कागज की प्रति व्यक्ति खपत सबसे कम है।

**सारणी 30.2**

**विभिन्न देशों में कागज की खपत**

| देश | प्रति व्यक्ति (किग्रा० में कागज की खपत) |
|---|---|
| भारत | 1.4 |
| अमरीका | 205 |
| ब्रिटेन | 106 |
| रूस | 16 |
| जापान | 57 |
| विश्व | 26.7 |

सन् 1980 में कागज की प्रति व्यक्ति संभावित आवश्यकता 6 किग्रा० आँकी जाती है। शंकुवृक्षों और बाँस-सरीखी लम्बे रेशों वाली जातियों की कमी के कारण ही यूकेलिप्टस सरीखे छोटे रेशे वाले पेड़ों का उत्पादन बढ़ाने की जरूरत महसूस हुई। ऊपर वर्णित पहली कोटि के वृक्षों की तुलना में (प्रति वर्ष 2.5 टन प्रति हेक्टेयर) बाद वाली दूसरी कोटि के वृक्षों यानी यूकेलिप्टस की उपज अधिक होती है (प्रति वर्ष 10 टन प्रति हेक्टेयर)।

### प्लाईवुड

यह लकड़ी की एक पतली परत या चादर है जो लकड़ी के लम्बे लट्ठे या बोटे को तराशने या छीलने से प्राप्त की जाती है। हमारे देश में प्लाईवुड की खपत बहुत कम है (प्रति 1000 व्यक्ति 0.2 घन मीटर), जबकि एशिया में यह 1.5, रूस में 5.9, अमरीका में 48.0 और विश्व में 6.7 है। सागौन, रोजवुड और अखरोट से प्लाईवुड के लिए कच्ची सामग्री प्राप्त होती है। हमारा देश प्लाईवुड का आयात करता है लेकिन अब इसके उत्पादन के लिए वह स्रोत साधनों की वृद्धि करता जा रहा है। अन्य प्रकार की सस्ती लकड़ी ढूंढ़ कर और छीजन में कमी करके प्लाईवुड के मूल्य में कमी की जा सकती है।

### राल (रेज़िन)

ये पेड़ों की कुछ जातियों से निकलने वाले निस्राव (एक्सूडेशन) या रिसे हुए पदार्थ हैं। गोंद के विपरीत ये एल्कोहॅल में घुल जाते हैं। अपने देश में राल का महत्वपूर्ण स्रोत चीड़ का पेड़ है। भूमि से कुछ सेंमी० ऊपर पेड़ के तने पर एक खाँच बना दी जाती है और फिर इस खाँच से होते हुए राल को टपकाकर प्याले में भर लिया जाता है। इसके आसवन से 25% तारपीन (टर्पेन्टाइन) और 5% राल प्राप्त होता है। साबुन और पेन्ट बनाने में राल का प्रयोग किया जाता है।

### गोंद (गम)

विकृत हो जाने के बाद पेड़ों की कोशिका-भित्तियाँ गोंद सरीखे पदार्थ देती हैं। ये रिस कर तभी निकलते हैं जब पेड़ों को क्षति पहुँचती है। मिष्ठान्नों और दवाइयों में गोंद का इस्तेमाल किया जाता है। गोंद स्रावित करने वाले सामान्य पेड़ हैं — बबूल, सलाई और धावड़ा। 'कुलू ट्री' का गोंद आइसक्रीम को गाढ़ा करने के काम आता है। पेड़ों का दोहन करके उनको नष्ट नहीं कर देना चाहिए, बल्कि यह दोहन ऐसा होना चाहिए कि गोंद की अधिक से अधिक प्राप्ति हो और पेड़ को भी कम से कम क्षति पहुँचे।

## औषधीय पौधे

कई झाड़ियों और वृक्षों से ऐसे कच्चे पदार्थ प्राप्त होते हैं जिनका दवाओं के निर्माण में उपयोग होता है। औषधीय पदार्थ प्रदान करने वाले कुछ सामान्य वृक्षों का वर्णन आगे किया जाता है।

### (1) एम्बिलका आफिसिनेलिस (आँवला)

यह पतझड़ी पेड़ है जो जंगलों में पाया जाता है और अब उगाया भी जाता है। इसके फलों से तैयार किया गया मृदु विरेचक (लैक्सेटिव) 'त्रिफला' विवर्धित यकृत (बढ़ा हुआ कलेजा) और आँखों के दर्द में इस्तेमाल किया जाता है। आँवले के फलों से तैयार किया गया किण्वित (फर्मन्टेड) रस का उपयोग अपाचन, अरक्तता (ऐनीमिया) और पीलिया में किया जाता है। फलों में विटामिन सी प्रचुरता से पाया जाता है।

### (2) मधुका इन्डिका (महुवा)

यह एक लम्बा पतझड़ी वृक्ष है जो हिमालय-क्षेत्र में उगता है। कुछ स्थानों पर तो यह जंगल की बनस्पति का एक मुख्य घटक होता है। वृक्ष की छाल का काढ़ा खुजली और मसूढ़ों से खून निकलने में प्रयुक्त होता है। किसी अंग के जलने पर इसकी पत्तियों को घी के साथ मिलाकर लगाया जाता है।। श्वसन सम्बन्धी विकारों में इसके फूलों का प्रयोग किया जाता है।

### (3) ब्यूटिया मोनोस्पर्मा (पलाश, ढाक)

यह एक मझोले कद का पेड़ है, जो लाख के कीट का परपोषी वृक्ष है। यह सारे भारत में सूखे पतझड़ी वनों में उगता है। पेड़ से निकलने वाले गोंद में टैनिन होता है जिसे दस्त (डायरिया) में इस्तेमाल किया जाता है। इसके बीजों से गोलकृमियों (राउन्डवर्म) और फीता-कृमियों (टेपवर्म) के नियंत्रण में सहायता मिलती है।

### (4) सिनकोना

इस पेड़ की छाल से कुनैन प्राप्त होती है जिसे मलेरिया और जीवाणविक (बैक्टीरियल) संक्रमण में प्रयुक्त किया जाता है। आँख के लोशनों में भी इसका इस्तेमाल होता है। लेकिन इसकी अधिक मात्रा से बहरापन, अंधापन और मतली हो जाती है।

### (5) एट्रोपा बेलाडोना (बेलाडोना, डेडली नाइटशेड)

इसकी जड़ों और पत्तियों को कम तापमान पर सुखाकर फिर उनका चूरा कर लिया जाता है। दमा में बेलाडोना की पत्तियों को जलाकर और धुएं को साँस के साथ अन्दर खींचने से बहुत फायदा पहुँचता है। इससे निकले ऐट्रोपीन नामक ऐल्केलाइड को आँख के स्रवण रिफारण (डाइलेशन) और आँख के दर्द में इस्तेमाल किया जाता है।

### (6) पाइनस रौक्सबर्गाई (चीड़)

पहाड़ों पर पाया जाने वाला यह एक लम्बा वृक्ष है जिसमें सुई-जैसी पत्तियाँ होती है। इस वृक्ष से प्राप्त होने वाला तेल उद्दीपक (स्टिमुलेन्ट) तथा कफोत्सारक (एक्सपेक्टोरेन्ट) होता है और चिकारी श्वसनीशोथ (क्रोनिक ब्रोन्काइटिस) में लाभकारी होता है। यह कब्ज दूर करने में भी सहायक होता है।

### (7) टेरोकार्पस मार्सूपियम (काइनो ट्री)

यह एक लम्बा वृक्ष है जो मिश्र पतझड़ी वनों में पाया जाता है। इससे 'काइनो गम' नामक गोंद प्राप्त होता है, जो संकोचक होता है और दस्त में लाभकारी रहता है। कभी-कभी मधुमेह के रोगियों को इसकी लकड़ी में रखा हुआ पानी दिया जाता है।

मानव की तेजी से बढ़ती हुई आबादी के कारण वनों की माँग और पूर्ति की खाई बढ़ती ही जा रही है। कटान द्वारा वनों का सफाया करने तथा वनों की संपदा का नाश और विलोप करने के कारण भूमि का अपरदन (इरोजन), भूमि की उर्वरता में कमी और जलवायु में परिवर्तन हो जाता है। अपरदन का कारण यह है कि भूमि नंगी होकर हवा और पानी की प्रत्यक्ष प्रतिक्रिया के लिए खुली पड़ जाती है। वानिकी (फौरेस्ट्री) या वनों के वैज्ञानिक अध्ययन के अनुप्रयोग से हम लोग इस समस्या से तभी उबर सकते हैं जबकि व्यक्ति और सरकार दोनों वनों की अर्थव्यवस्था को मजबूत करने वाली भूमिका को समझें। वनों से हमें जो फायदे हैं उसी से स्पष्ट हो जाता है कि उचित प्रकार से इनकी रक्षा और संरक्षण होना चाहिए। अपर्याप्त वन क्षेत्रों, पशुधन, कम महत्व की जातियों और धीरे-धीरे वृद्धि करने वाली जातियों के पहलू से ही इस बात की आवश्यकता पड़ी कि छीजन कम से कम की जाय और इस सन्दर्भ में वैज्ञानिक तकनीकों को अपनाया जाय। भूमि में वन रोपन, वृक्षों की तेजी से बढ़ने वाली महत्वपूर्ण जातियों को लगाना, आग से पेड़ों

का बचाव, जानवरों की नियंत्रित चराई और वनस्पति आवरण के प्रति कम से कम छेड़छाड़ आदि कुछ ऐसी विधियाँ हैं जिन्हें वनों को बनाए रखने के लिए सुझाया जाता है।

## अभ्यास

1. वानिकी (फौरेस्ट्री) शब्द की परिभाषा बताओ।
2. 'किसी राष्ट्र की अर्थव्यवस्था में वन महत्वपूर्ण भूमिका निभाते हैं'—इस कथन की पुष्टि करो।
3. वनों के सुधार के लिए सरकार ने क्या उपाय अपनाए हैं ?
4. दृढ़ काष्ठ (हार्ड वुड) और मृदु काष्ठ (सौफ्ट वुड) से क्या समझते हो ? प्रत्येक को उदाहरण सहित समझाओ।
5. लकड़ी के उपयोगों का वर्णन करो।
6. 'प्रति व्यक्ति कागज़ की खपत का सूचकांक ही राष्ट्र की प्रगति का सूचक होता है'—इस कथन की समीक्षा करो।
7. निम्नलिखित पदार्थों को उत्पन्न करने वाले दो पेड़ों का नाम बतलाओ।
   (क) गोंद।
   (ख) राल (रेज़िन)।
   (ग) औषधि।
8. बतलाओ कि वनों का संरक्षण (कंजर्वेशन) किस प्रकार किया जा सकता है ?

# अध्याय-31

# मानव की सेवा में जंगल के कीट

मानवता के कल्याण मे वन के पारितंत्र (पारिस्थितिक तंत्र—ईकोसिस्टम) का प्राणी घटक भी महत्वपूर्ण भूमिका निभाता है। वन का यह प्राणी घटक या प्राणी समुदाय वन के पेड़ों पर जीवन बिताता है। वन के प्राणीजात (फौना) से कई किस्म के औद्योगिक और व्यापारिक उत्पाद प्राप्त होते है । कुछ छोटे-छोटे कीट वन और राष्ट्र की अर्थव्यवस्था में बहुत अधिक योग देते हैं क्योंकि वे अनेक उद्योगों के लिए कच्ची सामग्री प्रदान करते हैं। इस प्रसंग में मक्षिकाओं या मधुमक्खियों, शलभों (मॉथ) तथा लाक्षा कीट या लाख कीट का नाम लिया जा सकता है। बहुत प्राचीन समय से ही ये कीट प्राकृतिक रूप से वनों में पाये जाते रहे हैं। जैसे-जैसे हमारी वैज्ञानिक जानकारी बढ़ती गयी वैसे-वैसे इनका आर्थिक महत्व भी अधिक महसूस किया जाता रहा। उपलब्ध तकनीकों और साधनों से लोग इनका पालन-पोषण भी करने लगे। अब हम इस बात का अध्ययन करेंगे कि ये छुद्र प्राणी किस तरह मानव के काम आते हैं और कैसे उसके रहन-सहन को उत्तम बनाते हैं।

## मधुमक्षिपालन (एपिकल्चर)

मधुमक्षिपालन शब्द के अर्थ का पता साफ-साफ लग जाता है कि मक्षिकाओं की देखभाल और प्रबन्ध। चूंकि ये मक्षिकायें (बी) शहद और मोम उत्पन्न करती हैं इसीलिए इन्हें शहद की मक्खी या मधुमक्खी कहते हैं। वेदों और रामायण के अध्ययन से पता चलता है कि मधुमक्खी पालन उस समय भी प्रचलित था। लेकिन उस समय इन्हें पालने वालों के तरीके बड़े अपरिष्कृत और अलाभकारी थे। उनसे बहुत शहद बेकार चला जाता था और कीटों की भी मृत्यु हो जाती थी। उन्नीसवीं शताब्दी में ही उन्नत तकनीकों से इस क्षेत्र में कुछ प्रगति की जा सकी जबकि हिलाये-डुलाए जा सकने वाले छत्तों के चौखटे और शहद निकालने के उन्नत तरीकों की खोज की गई।

मानव के लिए लाभकारी कीटों में मधुमक्खियाँ भी आती हैं। हमारे देश में आमतौर पर पायी जाने वाली प्रसिद्ध जातियाँ ये हैं—**एपिस डौर्सेटा, ए० फ्लोरिया ए० इण्डिका**। ये कीट मकरन्द (**नैक्टर**) उत्पन्न करने वाले फूलों के परागण में सहायता पहुँचाते हैं। मधुमक्खी के डंक से कभी-कभी पेशीय (मस्कुलर), तंत्रिकीय (नरवस), नितंबी (शिएटिक) दर्द तथा गठिया में काफी फायदा पाया गया है।

वह स्थान जहाँ मधुमक्खियों का संवर्धन किया जाता है और व्यापारिक उत्पाद प्राप्त करने के लिए उनका पालन-पोषण किया जाता है **मधुमक्षिशाला** (एपियरी) कहलाता है। मधुमक्खी पालने वालों के पास यदि निम्नलिखित बातें हों तो वे अपने व्यवसाय को उन्नत करके उसे बहुत लाभकारी बना सकते हैं: (1) यदि

उनके पास काफी संख्या में इनकी कोलोनियाँ हों, (2) यदि उनके पास बड़ी व स्वस्थ कोलनियाँ और अच्छे विभेद (स्ट्रेन) हों, (3) यदि उनके पास शुद्ध शहद निकालने तथा उसको बेचने के उपयुक्त साधन हों। इनके अतिरिक्त उन्हें मधुमक्खियों की आदतों व व्यवहार, मधुमक्खियों की प्रजातियों के सुधार, शहद उत्पन्न करने वाले पौधों तथा स्थान विशेष की शहद प्राप्ति से सम्बद्ध जानकारी भी होनी चाहिए। हमारे देश में जलवायु, पुष्पन का मौसम तथा वनस्पतियों की प्रकृति आदि **मधुमक्खी** पालन के अनेक सीमाकारी कारक हैं।

मधु या शहद सुगंध वाला, गाढ़ा और मीठा पदार्थ है, जो पौधों के मकरन्द से प्राप्त होता है। इसमें दो मुख्य शर्कराएँ—**डैक्स्ट्रोज** व **लीवुलोस**, नमी, वर्णक (पिगमेंट), एंज़ाइम, पराग-कण आदि पदार्थ होते हैं।

इसमें जो शर्करा होती है वह आसानी से स्वांगीकृत हो जाती है यानी पचा ली जाती है और रक्त में सोख ली जाती है, जो एकदम ऊर्जा देती है। शहद रक्त के हीमोग्लोबिन का निर्माण करने में सहायता देता है। डबल रोटी, बिस्कुट आदि बनाने में भी इसका उपयोग होता है। आयुर्वेदिक और यूनानी प्रणाली की औषधियों के सक्रिय पदार्थ के वाहक के रूप में भी इसका प्रयोग होता है। इसे मृदु विरेचक (लक्सेटिव), रक्त का शोधन करने वाला तथा खाँसी-जुकाम का विरोधी पदार्थ भी कहा जाता है। एल्कोहलीय पेयों, त्वचा व सौन्दर्य सम्बन्धी लोशनों और फलों के परिरक्षण-पदार्थ के रूप में भी इसका उपयोग होता है।

मधुमक्खियाँ वैक्स बनाती हैं जिसे सामान्य भाषा में, मोम, सिंधी, लेलिन आदि कहते हैं। यह पदार्थ मक्षिकाओं द्वारा गरमी के महीनों में बनाया जाता है। मोम के रंग पर धूप के प्रकाश का बहुत असर पड़ता है। हमारे देश में मधुमक्खियों के मोम का मुख्य स्रोत **एपिस डौर्सेटा** है क्योंकि इसका छत्ता बड़ा होता है। मोम के कई उपयोग हैं। मन्दिरों और गिरजाघरों में इसका चढ़ावे के रूप में उपयोग होता है। विभिन्न प्रकार के सोने, चांदी व पीतल के साँचों की मोम द्वारा परिष्कृति की जाती है। मरहम, प्लास्टर और छपाई उद्योग में भी इसका प्रयोग किया जाता है।

## रेशम कीट पालन (सेरिकल्चर)

रेशम उत्पादन के लिए कीटों का प्रजनन और प्रबन्ध रेशम कीट पालन या सेरिकल्चर कहलाता है। **बौम्बिक्स मोराइ**, जिसे *सामान्य भाषा* में रेशम कीट (सिल्क वर्म) कहते हैं, वह कार्य करता है जो कोई भी अन्य कीट नहीं कर सकते।

रेशम-कीट सबसे पहले चीन में उनके परपोषी वृक्षों यानी शहतूत के पेड़ों (**मोरस एल्बा**) पर देखे गए। चूंकि इन कीटों को चीन से बाहर ले जाना वर्जित था, ये कीट चीन से भारत में अंडों के रूप में एक राजकुमारी द्वारा लाए गए थे। अपने आरम्भ से ही रेशम कीटों ने अपनी खाने की आदतें नहीं बदली हैं। शहतूत का पेड़ तो बिना रेशम-कीटों के रह सकता है लेकिन रेशम कीट शहतूत के पेड़ के बिना अच्छा रेशम उत्पन्न नहीं कर सकते। इसे 'वर्म' इसलिए कहते हैं क्योंकि इसके जीवन-इतिहास में एक सुस्पष्ट वर्म जैसी यानी कृमि-जैसी अवस्था आती है। परपोषी-खाद्य के आधार पर इसे *शहतूत खाने वाले* (पालतू) और *शहतूत न खाने वाले* (वन्य) रेशम कीटों में वर्गीकृत किया जा सकता है। जे० ओरिंगटन ने सन् 1689 में ज्ञात किया कि भारत की जलवायु एक साल में इसकी कई पीढ़ियों (छह गुना) को उत्पन्न करने के अनुकूल है जबकि इंग्लैन्ड में यह साल में केवल एक बार ही प्रजनन कर पाता है। एक पीढ़ी में रेशम की जितनी प्राप्ति होती है उसे 'बैन्ड' कहते हैं।

## लाख संवर्धन (लैक कल्चर)

लाख रालदार पदार्थ है जो एक कीट के रिसाव से प्राप्त होता है और जो प्राणी स्रोत वाला पदार्थ है। 'लाख' शब्द की व्युत्पत्ति संस्कृत के 'लाक्षा' शब्द से हुई है—जिसका अर्थ है सैकड़ों हजार, और यह नाम संभवतया लाख की एक पपड़ी से असंख्य डिम्भकों (लार्वा) के निकलने के आधार पर ही पड़ा है। लाख-कीट **टैकार्डिया लैका** भारत के लिए वस्तुतः विशेष क्षेत्री (एन्डीमिक) है। जिन परपोषी पौधों पर यह कीट पनपता है वे ये हैं—पलाश (**ब्युटिया फ्रौन्डोसा**), बेर (**जिजिफस जुजुबा**) और कुसुम (**श्लेईहेरा ओलिओसा**)।

लाख की गुणता या किस्म उस पौधे पर निर्भर करती है जिस पर कि कीट पोषण प्राप्त करता है।

लाख के संवर्धन का आरम्भ जनन-लाक्षा (ब्रूड लैक) से होता है, जो कि परपोषी पौधे की टहनी पर कीटों वाली पपड़ी होती है। कीट फिर परपोषी पेड़ों पर फैल जाते हैं, प्रजनन करते हैं और रालदार परत का स्रवण करते हैं जिससे लाख प्राप्त होता है। साल में इसकी चार फसलें उत्पन्न की जा सकती हैं। कच्चे उत्पाद को टहनियों पर से खुरच लिया जाता है और फिर विलेयक गन्दे पदार्थों को साफ करने के लिए इसे पानी से धो लिया जाता है, और इस तरह कण लाक्षा या सीड लैक प्राप्त कर ली जाती है। चपड़ा (शेलैक) प्राप्त करने के लिए कण-लाक्षा को तप्त प्रगलन-प्रक्रम (हॉट स्मेल्टिंग प्रौसेस) द्वारा संसाधित किया जाता है। वार्निश की पौलिश, ग्रामोफोन के रेकार्ड और छपाई की स्याही बनाने में इसका प्रयोग किया जाता है। फेल्ट हैट को कड़ा करने और चमड़े की परिष्कृति करने में भी इसका प्रयोग किया जा सकता है।

इससे लाल रंजक (डाइ) और रालदार लाख प्राप्त होती है। रालदार लाख को सामान्य राल (रेज़िन) और मोम के साथ अपमिश्रित करने या मिलाने में प्रयुक्त किया जाता है।

## अभ्यास

1. रेशम कीट पालन (सेरीकल्चर) शब्द की परिभाषा बताओ।
2. मधुमक्खी के मोम और शहद के विविध उपयोगों का संक्षेप में वर्णन करो।
3. मधुमक्षिपालन (एपिकल्चर) मानव के उत्तम रहनसहन में किस प्रकार सहायक हो सकता है ?
4. लाख क्या है ? इससे सम्बद्ध कीट और परपोषी पौधों के वैज्ञानिक नाम बताओ।
5. मधुमक्खी की तीन जातियों के नाम बताओ।
6. लाख मानव के लिए किस प्रकार लाभदायक है ?

# अध्याय-32

# पशुधन

पशु हमें दूध और दूधउत्पाद प्रदान करते हैं जिनसे भारतवासियों को अपने भोजन में प्राणि प्रोटीन प्राप्त होते है। भारत की कृषि अर्थव्यवस्था में पशु बहुत महत्वपूर्ण भूमिका निभाते हैं। किसी कृषक के लिए भूमि के बाद की कीमती चीजें पशु ही हैं। अपने देश की कृषि सम्बन्धी विभिन्न संक्रियाओं में गतिदायी शक्ति (मोटिव पावर) के रूप में बैलों का विस्तृत रूप से उपयोग होता है। पशुओं के गोबर की खाद भूमि की उर्वरता को बनाए रखती है, इस बात को सभी भली भाँति जानते हैं। लेकिन ईंधन के रूप में प्राय: इसके प्रयोग से इसका गलत इस्तेमाल होता है। पशुओं की खाल और चमड़े से कई प्रकार की वस्तुएँ बनाई जाती है। भारत से खाल और चमड़े का बहुत अधिक निर्यात होता है।

## हमारी पशु संपदा

गाय, भैंसें हमारे पशुधन (लाइवस्टाक) के महत्वपूर्ण अंग हैं। 1965-66 के दौरान भारत के पशुधन की आबादी 34·3 करोड़ थी जिनमें 17·6 करोड़ भेड़ें, 6·4 करोड़ बकरियाँ और बाकी अन्य पशुधन था। भारत में एक गाय से हमें वर्ष में औसतन 173 लिटर दूध प्राप्त होता है और भैंस से करीब 491 लिटर। यह आँका गया है कि 100 में से करीब 70 गायें व भैंसें दूध देती ही नहीं हैं। डेयरी वाले पशुओं में से अधिकांश पशु प्रति दिन एक लिटर से कम दूध देते हैं और 20 प्रतिशत भैंसें प्रति दिन करीब 2 लिटर दूध देती हैं। गाय की तुलना में भैंस से दूध की प्राप्ति तथा उसका वसा (चर्बी) वाला अंश बहुत अधिक होता है। इसके अलावा गाय की अपेक्षा भैंस की अनुकूलनशीलता, रोग के प्रति रोधक्षमता और आयु अधिक होती है। भैंसे को गरीब आदमी का ट्रैक्टर कहा जाता है। सारणी 32·1 में भारत तथा अन्य देशों में वर्ष में गाय से औसत रूप से प्राप्त होने वाले दूध की माला दर्शाई गई है।

### सारणी 32·1

**एक वर्ष में एक गाय से प्राप्त होने वाले दूध की औसत माला**

| | |
|---|---|
| नीदरलैंड | 4220 लिटर |
| अमरीका | 4250 ,, |
| डेनमार्क | 3710 ,, |
| ब्रिटेन | 2990 ,, |
| पाकिस्तान | 420 ,, |
| भारत | 220 ,, |

### पशुओं की नस्लें

भारत में गायों और भैंसों की कई महत्वपूर्ण नस्लें हैं (सारणी 32·2, 32·3)। इनके शरीर के गठन, रंग,

सींगों, ललाट तथा भौगोलिक वितरण के आधार पर इनकी पहचान की जा सकती है। इनकी कुछ नस्लों से उत्तम बैल प्राप्त होते हैं और कुछ नस्लें दुग्ध उत्पादन के लिए उत्तम होती हैं।

### सारणी 32.2

### भारत में गाय-बैलों की महत्वपूर्ण नस्लें

| | |
|---|---|
| अमरिथमहल | देवनी |
| गिर | हरियाणा |
| कांगायम | कंकरेज |
| मालवी | नागोरी |
| अंगोली | रेड सिंधी |
| साहिवाल | थारपार्कर |

### सारणी 32·3

### भारत में भैंसों की महत्वपूर्ण नस्लें

| | |
|---|---|
| मुर्रा | नागपुरी |
| जाफराबादी | मेहसाना |
| नीली-रावी | सूरती |

## पशुओं का संभरण

पुरानी कहावत है कि सबसे अच्छा दूध संतुष्ट गायों से प्राप्त होता है। हमारे देश में भोजन और चारे की कमी के कारण ही दूध का कम उत्पादन होता है। संतुलित चारे या भोजन का मतलब है उसमें कार्बोहाइड्रेटों, वसाओं, प्रोटीनों, खनिजों, विटामिनों तथा जल सरीखे पोषक पदार्थों का उचित मात्रा में होना। भोजन या चारे को दो सामान्य वर्गों में बाँटा जा सकता है—रूक्ष या मोटा चारा (रफेज़) और सांद्र पदार्थ। मोटे चारे में रेशा बहुत अधिक मात्रा में होता है और इसके अन्तर्गत सूखी घास, चारा (फौडर) और साइलेज हैं। सांद्र मिश्रण (कॉनसेन्ट्रेट मिक्स्चर) दानों तथा धान्यों व चने की भूसी, बिनौले की खली सरीखे बीज-उत्पादों से बनता है। सामान्य भोजन या चारे के संपूरक खाद्य के रूप में पोषी खनिज पदार्थ भी दिए जाते हैं।

घासें पशुओं के सामान्य और सबसे अधिक पोषी खाद्य पदार्थ हैं। सूडान ग्रास, रोडीज ग्रास, नेपियर ग्रास, गिनी ग्रास और ऐलीफेन्ट ग्रास आदि कुछ चारे की घासें हैं जो अधिक पोषक तत्वों वाली होती हैं। अगेथी, बरसीम, रिजका (लूसर्न), लोबिया तथा अन्य प्रकार का फलीदार (लेगुमिनस) चारा बहुत अधिक पोषी होता है और इसे पशु बड़े स्वाद से खाते हैं। बाढ़ और अकाल या चारे की कमी के समय पशुओं की हालत बड़ी दयनीय हो जाती है। इस प्रकार की कमी हो जाने पर ऐसे क्षेत्रों में इनकी आपूर्ति के लिए कुछ चारा-बैंक स्थापित किए गए हैं। शुष्क महीनों के लिए सूखी घास या साइलेज (हरे चारे का गूदेदार रूप) के रूप में हरे चारे को सुरक्षित रखा जाता है।

## डेयरी उत्पाद

हाल के आँकड़ों के अनुसार भारत में दूध का उत्पादन 2·5 करोड़ मीट्रिक टन है, जिसमें भैंस का दूध 1·6 करोड़ मीट्रिक टन, गाय का दूध 84 लाख मीट्रिक टन और बकरी का दूध 6·8 लाख मीट्रिक टन है। इससे पता चलता है कि गाय की अपेक्षा भैंस अधिक दूध देती है। पशुओं से कई किस्म के डेयरी-उत्पाद प्राप्त होते है। हमारे देश में उत्पन्न दूध के करीब 39% की खपत दूध के रूप में और बाक़ी की खपत निम्नलिखित उत्पादों के रूप में होती है :

1. **दूध** : पूर्ण दूध—इसमें सभी प्राकृतिक वसाएँ होती हैं। सपरेटा दूध (स्किम्ड मिल्क)—क्रीम निकालने के बाद बचा दूध।
2. **दुग्ध उत्पाद** : क्रीम, पनीर (चीज़), दही, मक्खन, घी, खोया, आइस क्रीम, केसीन।
3. **सांद्र दुग्ध उत्पाद** : मधुरित या मीठा किया हुआ संघनित दुग्ध (स्वीटेन्ड कन्डेन्स्ड मिल्क), दुग्ध चूर्ण या मिल्क पाउडर (पूरी क्रीम वाला तथा सपरेटा), शिशु दुग्ध आहार, माल्ट मिश्रित दुग्ध आहार।
4. **अन्य उत्पाद** : गोमांस (बीफ), भैंस का मांस, खाल, चमड़ा, हड्डियाँ, बाल।

पशुओं का गोबर उत्तम फार्म यार्ड खाद है। गोबर-गैस ऊर्जा का बहुत अच्छा स्रोत है जिसका हाल में कई

तरह से उपयोग हो रहा है। जैवगैस या बायो गैस उत्पन्न करने के बाद भी अवशिष्ट में उर्वरक के गुण बराबर बने रहते हैं।

## भेड़ और बकरी

भेड़ पालन और ऊन उद्योग भेड़ पालने वाले लाखों किसानों और शिल्पियों की आजीविका का महत्वपूर्ण साधन है। भेड़ से मांस, ऊन और खाल तथा बकरियों से मांस, दूध, बाल तथा खाल प्राप्त होती है। भारत में भेड़ों और बकरियों की कुछ महत्वपूर्ण नस्लें निम्नलिखित हैं (सारणी 32.4 और 32.5)। ये शरीर की आकृति, सींगों के आकार और नाक की आकृति की दृष्टि से एक दूसरे से भिन्न हैं।

### सारणी 32.4
### भारत में भेड़ों की महत्वपूर्ण नस्लें

| | |
|---|---|
| गुरेज | लोही |
| बीकानेरी | मन्डया |
| भकड़वाल | डेक्कनी |
| नेलोर | बान्डुर |

### सारणी 32.5
### भारत में बकरियों की महत्वपूर्ण नस्लें

| | |
|---|---|
| जमुनापारी | बारबरी |
| सूरती | बंगाल |
| बीतल | मारवाड़ी |
| पश्मीना | मलाबार |

## भेड़ और बकरियों का संभरण

भेड़ हरी मुलायम घास या खर पतवार अथवा अन्य शाकों को चरती है। बकरियाँ कई किस्म के पेड़ों से पोषण प्राप्त करती हैं। वे पौधों की फुनगियों को चर जाती हैं। बकरियों की उचित देखभाल न होने से वनस्पतियों का नाश हो जाता है। भेड़ों को अच्छी अवस्था में बनाए रखने के लिए उन्हें खली और खनिज मिश्रण भी खिलाए जाते हैं।

## फार्म के पशुओं के रोग

पशु प्लेग (रिंडर पेस्ट), खुरपका (फूट ऐन्ड माउथ डिजीज), ऐंथ्रैक्स, ब्लैक क्वार्टर, रक्तस्रावी पूतिजीवरक्तता (हैमोरेजिक सेप्टीसीमिया) आदि कुछ महत्वपूर्ण रोग हैं जो फार्म पशुओं को होते हैं। उचित निरोधी व स्वच्छता उपायों से कई रोगों को नियंत्रित किया जा सकता है। सुचारु रूप से टीके आदि उपायों द्वारा पशु प्लेग और अन्य रोगों को काफी कम किया जा सकता है। पशुओं पर पड़ने वाले जूं सरीखे बाहरी परजीवियों (पैरासाइट) को लिन्डेन सरीखे कीटनाशियों (इनसेक्टीसाइड) के तनु या हल्के विलयन के प्रयोग से नियंत्रित किया जा सकता है। बछड़ों की मरने की समस्या भारी समस्या है और नवजात बछड़े की समुचित देखभाल करके पशुओं के नाश को रोका जा सकता है। पशु अन्य तकलीफों से भी पीड़ित होते हैं जैसे कि चोट, घाव, फोड़ा (ऐब्सेस), अस्थिभंग (फ्रैक्चर) आदि से। इन सभी बातों में समय पर नियंत्रण उपाय कर लिए जाने चाहिए और पशु चिकित्सा सम्बन्धी प्रसार कार्यकर्त्ताओं की सेवाओं का पूरा लाभ उठा लिया जाना चाहिए।

## गाय-भैंसों का प्रजनन

पशुओं के प्रजनन की दो विधियाँ हैं—प्राकृतिक और कृत्रिम प्रजनन। देशी गायों का विदेशी सांडों से—जैसे आयरशायर, जर्सी, ग्वीर्नसे, शौर्ट हौर्न, ब्राउन स्विस और होल्स्टीन-फ्राइसियन— संकरण कराकर नई नस्लें तैयार की जाती हैं। कृत्रिम प्रजनन में सांड का शुक्र (सीमेन) इकट्ठा करके गाय का गर्भ धारण कराया जाता है। विदेशी या देशी नस्लों की बहुत अच्छी गुणता वाले सांडों से ही शुक्र या वीर्य इकट्ठा किया जाता है। यह विधि कम खर्चीली है और इसमें यह फायदा भी है कि एक अकेले सांड से एकत्र किए गए शुक्र से अनेक दूरवर्ती स्थानों की हजारों गायों का गर्भ धारण कराया जा सकता है। स्थानीय दुधारू भैंसों का स्तर ऊंचा करने के लिए भैंसों की मुर्रा नस्लों की बड़ी मांग है। यह नस्ल भारत के अनेक स्थानों पर परिस्थितियों के प्रति अनुकूलता प्राप्त कर चुकी है।

### भेड़ और बकरियों का प्रजनन

प्रजनन कार्यक्रम में यह जरूरी है कि इस प्रकार की भेड़ी अथवा बकरियों को चुना जाय जो कि स्थानीय दशाओं के लिए सबसे अधिक उपयुक्त हों। ऊन तथा मटन की किस्म तथा प्राप्ति के लिए अलग-अलग नस्लें प्रसिद्ध हैं। डौर्सेट हौर्न, सफोक कोरीडेल अथवा मेरीनो जैसी भेड़ की विदेशी नस्लों के साथ संकरण कराकर स्थानीय नस्लों की ऊन की गुणता और मात्रा में सुधार किया जा रहा है।

## अभ्यास

1. 'गाय की अपेक्षा भैंस अधिक उत्तम डेयरी पशुधन है' — इस कथन की पुष्टि करो।
2. अपने देश की गायों और भैंसों की सामान्य नस्लों के नाम गिनाओ।
3. भोजन या चारे से हम क्या समझते हैं? इसके विभिन्न वर्ग और प्रत्येक वर्ग के विभिन्न अवयव या घटक बतलाओ।
4. भेड़ और बकरी की सामान्य नस्लों के नाम बतलाओ।
5. 'प्रजनन (ब्रीडिंग) से प्राणियों में दुग्ध उत्पादन और रोग प्रतिरोध की दृष्टि से सुधार हो जाता है' — इस सन्दर्भ में अपने उत्तर के साथ उपयुक्त उदाहरण भी दो।

# अध्याय-33

# कुक्कुटादि (पौल्ट्री)

## कुक्कुट पालन या मुरगी पालन

देश के कई भागों में मुरगी पालन के क्षेत्र में बहुत अधिक प्रगति हुई है, जिससे लोगों के पोषण और अर्थ-व्यवस्था को भारी योग मिला। कुक्कुटादि हमारी पोषण की समस्या से घनिष्ठ रूप से जुड़े हैं। कुक्कुटादि या मुरगा-मुरगी तथा इनके उत्पाद प्राणि प्रोटीन के बहुत अच्छे स्रोत हैं और अच्छे स्वास्थ्य के लिए उपयुक्त प्रकार की वसा प्रदान करते हैं। मुरगी पालन बड़ा आसान धंधा है जो विविध प्रकार की जलवायु में परिस्थितियों के अनुकूल हो जाता है। कुक्कुटादि की आयु कम होती है लेकिन बड़े पशुधन की तुलना में ये प्रचुरता से प्रजनन करते हैं।

भारतीय मुरगी का औसत उत्पादन करीब 60 अंडा प्रति वर्ष है। लेकिन अब कई अधिक उत्पादन करने वाली किस्में विकसित कर ली गई हैं जो प्रति वर्ष 240 अंडे तक देती हैं। आँकड़ों के अनुसार हमारे देश में 1973-74 का अंडों का कुल उत्पादन 770 करोड़ था। शहरों के इर्द-गिर्द भारी संख्या में फार्म स्थापित किए गए हैं जिनमें से किसी किसी में तो 1,000 से भी अधिक पक्षी होते हैं। मुर्गी पालन से बहुत से पढ़े लिखे और उद्यमी लोगों को रोजगार मिला है।

## कुक्कुटादि को चारा देना

कुक्कुटादि एक तरह से अपना आहार मुक्त रूप से स्वयं प्राप्त कर लेते हैं और अन्य प्रकार के पशु धन की अपेक्षा इनका चारा नियंत्रित नहीं होता। मुरगी मानव के अनचाहे या छोड़े हुए भोजन को अधिक पोषण-मान वाले भोजन में बदल देने में दक्ष होती है। कार्बोहाइड्रेट, वसा, प्रोटीन, खनिज, विटामिन और जल ही वे अनिवार्य पोषक पदार्थ हैं जिनकी आवश्यकता कुक्कुटादि को होती है। प्राकृतिक चारे या आहार में सभी पोषक पदार्थ होते हैं। यद्यपि इनकी सांद्रता भिन्न-भिन्न हो सकती है। चिड़ियों को दिए जाने वाले चारे या आहार में धान्य तथा मक्का, गेहूँ, चावल, ज्वार-बाजरा, रागी आदि धान्य उत्पाद सम्मिलित हैं। इनके चारे में खली या इसका चूरा, सांद्र रूप वाले प्रोटीन, मछली या मांस का चूरा, खनिज और साग-पात मिला दिए जाते हैं।

## कुक्कुटादि गृह या मुरगी खाना

उत्तम मुरगी पालन की पहली शर्त यह है कि चिड़ियों के रहने की व्यवस्था ठीक से रखी जाय। इनको आराम-दायक, सुसंवाहित, सूखे, साफ और उचित प्रकाश वाले घरों या बाड़ों में रखना चाहिए। भिन्न-भिन्न उम्र की

चिड़ियों को हमेशा अलग अलग घरों में रखना चाहिए। मध्यम प्रकार की जलवायु वाली दशाओं के क्षेत्रों में इनको रखने के लिए पिंजरे वाली विधि अपनाई जाती है। हमारी जलवायु और आर्थिक दशाओं में सबसे उपयुक्त और लोकप्रिय विधि फर्श-आवासन (फ्लोर हाउसिंग) की विधि है, जिसे मुक्त आवासन या तृण-शैय्या प्रणाली भी कहते हैं। पक्षी मुक्त रूप से इधर-उधर घूमते रह सकते हैं और फर्श घास-फूस से ढका रहता है। यह तृण-शैय्या (लिटर) कटे पुआल, धान के भूसे, मूँगफली के छिलकों या सूखी पत्तियों आदि किसी भी चीज से बनाई जा सकती है जो कि स्थान विशेष में सस्ते में उपलब्ध हो। कुक्कुट-गृहों को चूहों से बचाकर रखा जाता है और ऐसी व्यवस्था रहती है कि पक्षियों को ताजा जल मिलता रहे। इसके लिए बहते पानी की नालियों का प्रबंध रहता है। मुर्गी खाने को स्वच्छ रखने के लिए अपवाह-तंत्र (ड्रेनेज सिस्टम) भी जरूरी है।

## रोग और नियंत्रण

चारे की कमी और रोगों के कारण कुक्कुटादि का बहुत विनाश होता है। मुर्गी पालन उद्योग की सबसे प्रमुख शिकायत यह है कि यह खतरे से खाली नहीं है। रानीखेत, कोरिजा या कुक्कुट-हैजा आदि रोगों के फैलने से काफी पक्षियों की मृत्यु होती है। अच्छी व्यवस्था, उचित पोषण और चूजों की नई पीढ़ी आने पर टीका देने से रोगों को नियंत्रित किया जा सकता है। कई रोगों को ठीक करने के लिए सल्फा-औषधि वाला और विस्तृत प्रतिजैविक उपचार किया जाता है। पक्षियों को भीड़-भड़क्के, कुवातन और नमी से दूर रखना बहुत जरूरी है क्योंकि मुर्गी खानों में इनके कारण रोग फैलते हैं।

रोगों को फैलने से बचाने तथा उपचार के लिए संक्रमित पक्षियों को स्वस्थ पक्षियों से तुरन्त अलग कर कर देना चाहिए और पशु चिकित्सा सम्बन्धी सहायता ले लेनी चाहिए। कई रोग कुक्कुटादि को भिन्न-भिन्न समय पर प्रभावित करके अंडों का उत्पादन कम कर सकते हैं। कुक्कुटादि के कुछ महत्वपूर्ण रोग निम्नलिखित हैं :

**विषाणु (वाइरस) रोग** (वाइरल डिजीज): कुक्कुट-चेचक, रानीखेत रोग (या न्यूकैसल रोग)

**जीवाणु (बैक्टीरिया) रोग** —कुक्कुट, हैजा, साल्मनेलता (साल्मनेलोसिस), कोरिजा।

**कवकरोग (फंगल डिजीज)—ऐस्परजिलस**—आर्ति ऐस्पर्जिलोसिस।

**परजीवी रोग**

(क) **आन्तरिक परजीवी** : गोल कृमि, चपटे कृमि, सूत्रकृमि।

(ख) **बाहरी परजीवी** : मुर्गी-चिचड़ी (फाउल माइट), चूजा चिचड़ी (चिकन माइट), पिस्सू (फ्ली), किलनी (टिक), जूँ।

## प्रजनन

भारत में देशी मुर्गा-मुर्गियों की बहुत कम विशुद्ध नस्लें हैं, जैसे असील, बसरा, घागस, ब्रह्मा, कोचीन। असील एक उत्तम प्रकार की खाद्य चिड़िया है जिसका मांस स्वादिष्ट होता है। देशी पक्षियों की अंडे देने की क्षमता सामान्यतया बहुत कम होती है।

ह्वाइट लेगहॉर्न, रोड आइलैन्ड रैड, प्लीमथ रॉक, न्यू हैम्पशायर, ओर्पिंगटन, औस्ट्रेलोर्प, ससेक्स, मिनोर्का आदि विदेशज नस्लें हैं और देश में अंडों के उत्पादन के सुधार के लिए इनका उपयोग हो रहा है। इनमें से अधिकांश पक्षी आयातित, प्रजनित और स्थानीय दशाओं के प्रति अनुकूलित किए गए हैं। इनमें से कुछ किस्में अंडे देने की दृष्टि से उत्तम हैं और बाकी अच्छा मांस प्रदान करने वाली चिड़ियाँ हैं।

देशी नस्लों को सुधारने के लिए इन विदेशी या विदेशज पक्षियों का इस्तेमाल किया जा रहा है। संकर-ओज (हेटेरोसिस) की खोज के प्रभावों से कुक्कुटादि-प्रजनन के रुख में परिवर्तन हुआ है। कुक्कुटादि की उत्पादन-शीलता बढ़ाने के लिए संकरण का प्रयोग किया जा रहा है। कुछ नए संकर वंशक्रम (हाइब्रिड लाइन) प्रति वर्ष 230-240 अंडों का उत्पादन कर सकते हैं और साथ

ही उनकी मृत्यु दर भी कम होती है। कुछ संकर चूजों (मांस के लिए पाले जाने वाले पक्षी) की वृद्धि-दर लघु अवधि में ही बहुत अधिक हो जाती है और उनका पोषण-मान भी अधिक होता है।

## अभ्यास

1. कुक्कुटादि (पौल्ट्री) के चारे में क्या-क्या तत्व होते हैं ?
2. कुक्कुटादि के सामान्य रोगों के नाम गिनाओ और बताओ कि इनका नियंत्रण कैसे किया जा सकता है ?
3. कुक्कुटादि पालन या मुर्गी पालन में प्रजनन का क्या योग है ? उदाहरण दो।

# अध्याय-34

# मात्स्यकी (फिशरीज़)

## जल-कृषि--मात्स्यकी

मछलियाँ अधिक प्रोटीन वाले भोजन के महत्वपूर्ण और आसानी से प्राप्त होने वाले साधन है। मानव के पोषण में मछली के प्रोटीनों का महत्वपूर्ण स्थान है क्योंकि इनका पाचन आसानी से हो जाता है और इनमें वृद्धि को बढ़ावा देने वाले गुण भी होते हैं। भारत में मछलियों की अपार संपदा है जो अलवणीय (फ्रैश) तथा खारी दोनों प्रकार के जल में पायी जाती हैं। हाल के वर्षों में मात्स्यकी को बहुत अधिक बढ़ावा मिला है और वह इसलिए कि इनके प्रोटीन खाद्य पदार्थ के स्रोत के रूप में लोकप्रिय होने और इनके द्वारा निर्यात की बढ़ती आवश्यताओं की पूर्ति करने की बहुत अधिक संभावनाएँ हैं। मत्स्य उद्योग के विकास से रोजगार की संभावनाएँ भी बढ़ जाती हैं। भारत के पास मात्स्यकी (फिशरीज़) को एक सम्पन्न बड़े उद्योग में विकसित करने की पूरी क्षमताएँ हैं।

हमारे देश में लम्बी समुद्र तट रेखा और विशाल सागर संपदा ही नहीं है बल्कि असंख्य स्थानों पर जल अन्दर की ओर अंतः स्थलीय (इनलैन्ड) रूप में भी पसरा हुआ है। इसकी समुद्र तट रेखा 4667 किमी० तक फैली हुई है और महाद्वीपीय शेल्फ (कोन्टीनेन्टल शेल्फ) 2.59 लाख वर्ग किमी० क्षेत्र तक। इसके अतिरिक्त अंडमान निकोबार, लक्षद्वीप तथा मिनिकॉय द्वीप समूह, और गरान कच्छ (मैंग्रोव मार्श) से सम्बद्ध अप तटीय (ऑफ शोर) और समुद्र तटीय क्षेत्र समुद्री मछलियों के विशाल स्रोत हैं। इनके अलावा देश के जो पृष्ठीय या सतही जल क्षेत्र हैं वे अंतः स्थलीय मात्स्य के उत्कृष्ट केन्द्र हैं, और इनमें 27,360 कि०मी० लम्बी नदियाँ, करीब 1,12,650 किमी० लम्बी कुल्याएँ (केनाल) व सिंचाई वाली नहरें, अनेक जलाशय, ताल और तलैया सम्मिलित हैं। जल कृषि (ऐक्वा कल्चर) का अर्थ है अलवणीय जल, खारी जल और समुद्रतटीय क्षेत्रों के समुचित उपयोग से मछलियों का उत्पादन करना। प्रोटीन बहुल खाद्य पदार्थों का उत्पादन बढ़ाने और सहायक उद्योगों को आधार प्रदान करने तथा रोजगार बढ़ाने में जल-कृषि सचमुच महत्वपूर्ण रोल अदा करती है। इस प्रयोजन के लिए जल्दी-जल्दी वृद्धि करने वाली मछलियों को ही चुना जाता है।

1973-74 के दौरान हमारे देश में मछलियों का कुल उत्पादन 19.58 लाख टन था जिसमें समुद्री मछलियों का उत्पादन 12.10 लाख टन था। वर्तमान समय में भारत दुनिया के उन छह देशों में से एक है जो समुद्र से खाद्य पदार्थ उत्पन्न करते हैं। अन्य देशों को समुद्री खाद्य पदार्थ भेजने वाले देश के रूप में भारत उभर कर सामने आ रहा है।

### अंतः स्थलीय या अलवण-जलीय मात्स्यकी

अंतः स्थलीय मत्स्य उद्योग का सम्बन्ध उस जल से है जो समुद्री जल के अतिरिक्त होता है। अपनी

विशाल और विविध प्रकार की अंतः स्थलीय मत्स्य उद्योग संपदा की दृष्टि से भारत दुनिया का एक धनी देश है। यह जल दो प्रकार का होता है---अलवणीय और खारी। अलवणीय जल के अन्तर्गत देश के वृहत् नदी तंत्रों, सिंचाई वाली नहरों, जलाशयों, झीलों, ताल तलैयों आदि का विशाल जाल है। खारी या नुनखरे जल में ज्वारनदमुख (एस्चुअरी), लैगून और गरान अनुप (मैंग्रोव स्वैम्प) आते हैं।

संवर्धन-मात्स्यकी, जिसे कि मस्य पालन (पिसिकल्चर) भी कहते है, छोटे जल-क्षेत्रों से सम्बद्ध है और इसमें बीजरूप वाली मछलियों को बोकर, पाल-पोस कर अंत में खाए जाने वाले आकार तक बढ़ जाने पर पकड़ कर इनका उपयोग कर लिया जाता है। लेकिन इसके विपरीत नदियों, ज्वारनदमुखों (एस्चुअरी), बड़े जलाशयों तथा बड़ी झीलों से सम्बद्ध प्रग्रहण मात्स्यकी (कैप्चर फिशरीज) में बोआई नहीं होती और मछलियाँ केवल पकड़ी ही जाती हैं।

संवर्धन योग्य (कल्चरेबल) कुछ महत्वपूर्ण अलवण जलीय मछलियां निम्नलिखित हैं :

1. **कैटला** 2. **लेबियो**
3. **सिर्राइनस** 4. **बारबस**
5. **सिप्रिनस** 6. **मिस्टस**
7. **चैना** 8. **क्लैरियस**
9. **हेटरोन्यूस्टीस** 10. **टिन्का**

## समुद्री मात्स्यकी

समुद्री मत्स्य पालन (फिशरी) मछली पालन के समुद्री और महासागरों वाले पहलुओं से सम्बन्धित है। अभी कुछ समय पहले तक भारत में समुद्र से मछली पकड़ने की संक्रियाएं संकरे समुद्रतटीय क्षेत्रों तक ही सीमित थीं और अपतटीय तथा गहरे सागरी प्रदेश (डीप सी रीजन) अछूते थे। हाल के सर्वेक्षण से दक्षिण-पश्चिमी समुद्री अपतटों पर सारडीन, बाँगड़ा (मैकरल) आदि की अपार संपदा का पता चला है। देश के प्रमुख पत्तनों (पोर्ट) पर मत्स्यन पोताश्रय (हारबर) विकसित किए गए हैं। यांत्रिक मत्स्यन-नौकाओं (मेकेनाइज्ड फिशिंग बोट) का प्रचलन शुरू करके गहरे सागरी मत्स्यन (डीप सी फिशिंग) के विकास पर विशेष बल दिया गया है। मछलियों का पता लगाने वाले आधुनिक इलेक्ट्रोनिक उपस्कर (इक्विपमेन्ट) से सुसज्जित मत्स्यन-आनायकों (फिशिंग ट्रॉलर) का भी हाल के कुछ वर्षों से खूब प्रयोग किया जाने लगा है ताकि सागर की गहराइयों में मछली पकड़ने वाले धंधे को बढ़ावा दिया जा सके। कोचीन स्थित समेकित मात्स्यकी परियोजना केन्द्र (इन्टिग्रेटेड फिशरीज प्रोजेक्ट) दक्षिण पश्चिमी एशिया का अपने प्रकार का बहुत बड़ा केन्द्र है, जो समुद्री संपदा सम्बन्धी अन्वेषण में लगा है कि किस प्रकार पूरी तरह से दोहन किया जाय।

भारत के इर्द-गिर्द वाले सागरों में पाई जाने वाली महत्वपूर्ण मछलियाँ निम्नलिखित हैं :

1. **हिल्सा**
2. बांगड़ा (**मैकरल**)
3. बम्बिल (बम्बई डक)
4. शिंगटी (कैट फिश)
5. फीता मीन (रिबन फिश)
6. कड़ाकेला (रेड मलेट)
7. उड़न मीन (फ्लाइंग फिश)
8. सारडीन
9. तेल सारडीन (ऑयल सारडीन)
10. **मुजिल**

यह भी ध्यान देने योग्य बात है कि मात्स्यकी या मत्स्य विज्ञान में कुछ अन्य प्राणी—जैसे कि समुद्री झींगा या प्रौन, महाचिंगट (लोब्स्टर), झींगी (शिम्प), खाद्य सीप (इडिबल आयस्टर) तथा मोती-सीपी (पर्ल आयस्टर) भी सम्मिलित हैं।

हाल के वर्षों के दौरान समुद्री उत्पादों का निर्यात बहुत अधिक बढ़ा है। यह जरूर है कि शीत संग्रहण और परिवहन की अपर्याप्त सुविधाओं के कारण बाजार में भेजने के पहले ही पकड़ी मछलियों में काफी नुकसान होता रहा है। लेकिन हाल के कुछ वर्षों में शीत संग्रहण (कोल्ड स्टोरेज) और प्रशीतित परिवहन (रेफ्रीजरेटेड ट्रान्सपोर्ट) की सुवि-

धाओं में बहुत वृद्धि हुई है और अब देश में मछलियों को आसानी से अच्छी तरह इधर-उधर पहुँचाया जा सकता है। मछलियों के संसाधन (प्रोसेसिंग) में मछली उद्योगों में काफी कुछ अंश बेकार बच जाता है। इस कच्ची सामग्री से कुक्कुटादि उद्योगों के उपयोग के लिए मछली का चूरा या मत्स्य चूर्ण (फिश मील) तैयार किया जाता है ।

## अभ्यास

1. जल-कृषि (ऐक्वाकल्चर) शब्द की परिभाषा बताओ ।
2. मत्स्य पालन (पिसिकल्चर) से हम क्या समझते हैं ?
3. अपने देश की समुद्री मछलियों की महत्वपूर्ण जातियों के नाम गिनाओ ।

# अध्याय-35

# संचरणीय रोग

सामान्य स्वास्थ्य में जरा भी परिवर्तन हो जाने पर रोग हो जाता है। रोग शारीरिक, मानसिक अथवा सामाजिक किसी भी प्रकार के हो सकते हैं। मोटे तौर पर इन्हें दो वर्गों में बाँटा जा सकता है। पहली प्रकार के यानी **जन्मजात (कोनजैनाइटल)** वे रोग हैं जो पैदा होते ही लग जाते हैं और जो उपापचयी (मेटाबोलिक) गड़बड़ी या परिवर्धन सम्बन्धी दोषों के परिणामस्वरूप उत्पन्न होते हैं; और दूसरी प्रकार के रोग हैं **उपार्जित (अक्वायर्ड)** जो जन्म के बाद पनपते हैं।

उपार्जित रोगों को निम्नलिखित समूहों में बाँटा जा सकता है :

(i) **संक्रामक (इनफेक्शस) रोग** : जो विषाणु (वाइरस), जीवाणु (बैक्टीरिया), प्रोटोजोआ, कवकों और कृमियों (वर्म) के कारण होते हैं।

(ii) **व्यपजनन रोग (डीजेनेरेटिव डिज़ीज)** : जो फेफड़े, हृदय सरीखे महत्वपूर्ण अंगों तथा केन्द्रीय तंत्रिका तंत्र (सेन्ट्रल नरवस सिस्टम) की कुसंक्रियाओं से उत्पन्न होते हैं।

(iii) **हीनता जन्य (डेफीशिएन्सी) रोग** : जो एक या अधिक पोषक पदार्थों की कमी से उत्पन्न होते हैं।

(iv) **एलर्जी** : जो कुछ पदार्थों के प्रति शरीर की अतिसंवेदनशीलता से उत्पन्न होते हैं।

(v) **कैंसर** : जो शरीर के अंगों में ऊतकों की अनियंत्रित वृद्धि के कारण होते हैं।

उपार्जित रोगों में कुछ संक्रामक रोग संचरणीय (कम्युनिकेबल) होते हैं अर्थात ये ऐसे रोग हैं जो एक व्यक्ति से दूसरे व्यक्ति में बड़ी तेजी से फैल या पहुँच जाते हैं। इसलिए इन्हें **संचरणीय** रोग कहा जाता है। उपार्जित रोगों में अन्य रोग **असंचरणीय रोग** होते हैं।

सामुदायिक स्वास्थ्य की प्रमुख समस्या संचरणीय रोगों के नियंत्रण और रोकथाम की समस्या रही है। पहले इनका नियंत्रण व रोकथाम गम्भीर समस्या थी। प्लेग, टाइफस और ऐसे अनेक रोग पहले बहुत जानें लेते रहे हैं। पिछली शताब्दी में ही हम इन रोगों से सुचारु रूप से लड़ने के साधन ढूंढ़ पाए हैं। हाल के वर्षों में संचरणीय रोगों के प्रति हमारी सफलता ने जीवन के प्रति हमें अधिक आशावान बना दिया है। रोगों से इस लड़ाई में तीन महत्वपूर्ण चरण रहे हैं :

(क) इन रोगों की प्रकृति की जानकारी यानी रोगकारी जीव और उसका जीवनचक्र। इसके बारे में हमें जो जानकारी हुई है वह **परजीवीविज्ञान (पैरासिटोलॉजी)** के क्षेत्र में हुए अनुसंधानों के बल पर प्राप्त हुई।

(ख) रोगों के संचरण की विधि यानी रोगकारी जीवन मानव पर किस प्रकार आक्रमण करता

है । महामारी विज्ञान (एपिडीमोलॉजी) की सहायता से हम संचरण की विधि का पता लगा सके हैं और इस प्रकार हम जन स्वास्थ्य उपयोगों को सुनियोजित करने में सफल हो सके हैं ।

(ग) रोग के आक्रमण को रोकने की रक्षा-क्रिया-विधि का विकास । **प्रतिरक्षाविज्ञान (इम्म्यूनोलॉजी)** ने इन रोगकारी जीवों के आक्रमण के प्रति काफी अधिक सुरक्षा प्रदान की है ।

मानव ने इन संचरणीय रोगों के विरुद्ध किस प्रकार युद्ध ठाना ? बहुत पुराने समय से ही रोगों के प्रति मानव ने चिंता प्रकट की है । आरम्भिक मानव ने सोचा कि बीमारियाँ बुरी आत्माओं के कारण होती हैं । इसलिए उनके निराकरण और उपचार के लिए बुरी आत्माओं को संतुष्ट किया जाने लगा और रोकथाम के लिए यंत्र-तंत्र और जादू टोने का प्रयोग होने लगा ।

महान यूनानी चिकित्सक हिपोक्रेटीज (460-359 ई० पू० ) ने चार मनोदशाओं का सिद्धान्त प्रस्तुत किया । उसने कहा कि रोग चार तत्वों में—कफ, रुधिर, पीला पित्त और काला पित्त में— असंतुलन हो जाने से उत्पन्न होते हैं । इस तरह सोलहवीं शताब्दी तक उसका सिद्धान्त आयुर्विज्ञान के मत पर छाया रहा ।

## परजीवीविज्ञान की नींव

आज आधुनिक युग में संचरणीय रोगों की संकल्पना को जिस रूप में हम समझते हैं वह तभी संभव हो सका जबकि यह महसूस किया गया कि रोगाणु या जर्म ही रोग उत्पन्न करते हैं । सन् 1835 में सूक्ष्मदर्शी (माइक्रोस्कोप) का आविष्कार होने पर ही लोगों को रोगकारी सूक्ष्म जीवों की प्रकृति की जानकारी हुई । ज्यों-ज्यों मानव-परजीवियों के सम्बन्ध में हमारा ज्ञान बढ़ता गया त्यों-त्यों यह प्रकट होता गया कि संचरणीय रोग जीवाणुओं (बैक्टीरिया) और विषाणुओं (वाइरस) द्वारा होते हैं । रोगों के जर्म सिद्धान्त की स्थापना का श्रेय लुई पास्तेर और राबर्ट काख़ को जाता है । जैसे-जैसे जीवाणु सम्बन्धी हमारा ज्ञान बढ़ता गया वैसे-वैसे विभिन्न रोगों के लिए जिम्मेदार नए-नए जीवाणुओं की खोज होती रही । आज हमें अधिकांश जीवाणु-रोगों की पूरी जानकारी है । सन् 1890 में इस बात की खोज हुई कि तम्बाकू के पौधे का मोज़ेक रोग और पशुओं के खुर तथा मुख रोग ऐसे सूक्ष्म जीवों से होते हैं जो कि सूक्ष्मदर्शी में भी नहीं दिखलाई पड़ते । इसी से विषाणुओं (वाइरसों) के अध्ययन की नींव पड़ी । चेचक, खसरा, जुकाम, पोलियो आदि रोग विषाणुओं द्वारा होते हैं ।

## महामारी विज्ञान की नींव

जॉन स्नो को महामारी विज्ञान यानी संचरणीय रोगों के प्रसार सम्बन्धी विज्ञान का जनक माना जाता है । लन्दन से एशियाई हैज़ा की महामारी पर खोज करते हुए जॉन स्नो ने पता लगाया कि वह ब्रॉड स्ट्रीट में प्रदूषित (पौल्यूटेड) जल के कारण था, जो कि हैज़ा के रोगाणुओं (जर्म) से संदूषित था । इस प्रकार रोगकारी जीव की पहचान के पहले ही उसके फैलने की विधि की पहचान हो गई ।

## प्रतिरक्षाविज्ञान (इम्म्यूनोलॉजी) की नींव

इस बात की खोज के पहले कि सूक्ष्मजीव रोग उत्पन्न करते हैं महामारी विज्ञान और प्रतिरक्षाविज्ञान का कुछ ज्ञान हो गया था । प्रतिरक्षाविज्ञान के क्षेत्र में एडवर्ड जेनर द्वारा चेचक के टीके की खोज पहला कीर्ति स्तम्भ है । जेनर ने आम धारणा की परीक्षा की कि जिस व्यक्ति को गो चेचक हुई होती है, सामान्यतया वह चेचक के प्रति प्रतिरक्षित(इम्म्यून) होता है । उसने सजीव पदार्थ के प्रयोग से चेचक का टीका तैयार किया । लुई पास्तेर का प्रतिरक्षा विज्ञान में योगदान इस टीके के अनुभव वाले जर्म आधारित रोग के सिद्धान्त के अनुप्रयोग पर आधारित था । उसने अपना तर्क रखा कि यदि गाय के शरीर में चेचक के जर्म को निर्बल कर दिया जाय तो ताप, शीत, भुखमरी व अन्य साधनों से अन्य जर्मों (रोगाणुओं) को निर्बल या सक्रिय किया जा सकता है ।

एंथ्रैक्स के टीके का विकास और अलर्क या रेबीज़ का उपचार लुई पास्तेर के कुछ उल्लेखनीय योगदान हैं ।

आज हम प्रतिरक्षीकरण प्रक्रिया को अच्छी तरह समझ गए हैं और पुराने समय के कई खतरनाक रोग अब पूरे नियंत्रण में हैं। उचित स्वच्छता और जन स्वास्थ्य उपायों के परिणामस्वरूप इन रोगों की रोकथाम संभव हो गई है। हमारे देश में नियमित रूप से सामूहिक प्रतिरक्षी कार्यक्रम और सामुदायिक स्वास्थ्य सम्बन्धी प्रयत्नों से चेचक का उन्मूलन कर दिया गया है ।

## संचरणीय रोगों की प्रकृति, कारण और महामारी विज्ञान

विभिन्न संचरणीय रोगों की प्रकृति को समझने के पहले आधारभूत शब्द समूह का ज्ञान जरूरी है। इन रोगों के सम्बन्ध में हम कुछ शब्दों के सम्पर्क में आते हैं, जैसे कि संक्रमण, ग्रसन (इनफेस्टेशन), परजीविता (पैरासिटिज्म), रोगजनक (पैथोजन), प्रतिरोध (रेसिस्टेन्स) और सुग्रहिता (ससेप्टिबिलिटी) ।

**संक्रमण** का अर्थ है परपोषी (होस्ट) और परजीवी (पैरासाइट) के बीच होने वाली आपसी क्रिया, जिसमें एक दूसरे पर हावी होने या अधिकार जमाने की होड़ लगी रहती है। इसमें यदि परजीवी जीव जीत जाता है तो परपोषी में रोग उत्पन्न हो जाता है।

**ग्रसन** का अर्थ है परपोषी के शरीर में एक ही प्रकार के रोगकारी जीव का भारी संख्या में विद्यमान होना ।

**परजीविता** एक ऐसा सम्बन्ध है जिसमें एक जीव दूसरे के बल पर जीवित रहता है। संक्रमण एक प्रकार की परजीविता है ।

**रोगजनक** वह जीव है जो किसी रोग को उत्पन्न करने की क्षमता रखता है। रोगजनकता (पैथोजेनिसिटी) किसी रोगजनक की वह क्षमता है जिसके बूते पर वह परपोषी के शरीर में प्रवेश कर रोग के लक्षण उत्पन्न करता है । रोगजनकता की मात्रा उसकी उग्रता (विरुलेन्स) कहलाती है।

**प्रतिरोध** किसी जीव की वह क्षमता है जिसके बल बूते पर वह संक्रमण से टक्कर लेकर उसे दूर भगाता है । प्रतिरोध प्राकृतिक अथवा उपार्जित हो सकता है। उपार्जित प्रतिरोध रोग के पूर्व सम्पर्क या टीके के कारण हो सकता है।

## संक्रमण को प्रभावित करने वाले कारक

*कई कारक हैं जो संक्रमण पर प्रभाव डालते हैं :*

(क) **ऊतक बंधुता** (टिश्यू ऐफिनिटी) : कुछ रोगजनक (पैथोजेन) कुछ ऊतकों के प्रति अधिक आकर्षित होते हैं। कुछ जीवों में एक अवस्था में किसी एक ऊतक के प्रति और दूसरी अवस्था में किसी दूसरे ऊतक के प्रति आर्कषण या बन्धुता होती है। उदाहरण के लिए, किसी अवस्था में मलेरिया-परजीवी (मलेरियल पैरासाइट) अपने जीवन इतिहास में मानव की लाल रुधिर कोशिका पर संक्रमण करता है तो दूसरी अवस्था में मच्छर पर ।

(ख) **अतिसंवेदनशीलता** (हाइपरसेन्सिटिविटी) : प्राणियों के ऊतक कभी-कभी कुछ जीवाणु-कोशिकाओं अथवा उनके उपापचयी उत्पादों के प्रति असामान्य रूप से संवेदनशील हो जाते हैं। यक्ष्मा (ट्यूबरकुलेसिस) की उपस्थिति देखने के लिए त्वचा परीक्षण में इस तकनीक का प्रयोग किया जाता है। यह कारक (फैक्टर) कुछ में चिरकारी (क्रोनिक) रोग उत्पन्न करता है ।

(ग) **संक्रामक मात्रा** : परपोषी में रोग उत्पन्न करने के लिए जीवों की जितनी संख्या की आवश्यकता होती है उसे **संक्रामक मात्रा** कहते हैं। यह परपोषी और सूक्ष्म जीव के विभेद (स्ट्रेन) के प्रकार के अनुसार बदलती रहती है। यह संक्रामक मात्रा विभेद की उग्रता पर निर्भर करती है। अधिक उग्र विभेद को कम संक्रामक मात्रा की जरूरत होती है यानी रोगकारी जीव कम संख्या में ही रोग उत्पन्न कर सकता है ।

(घ) **प्रवेश द्वार** : संक्रमण करने के लिए रोगजनक को निश्चित रास्ते या प्रवेश द्वार से पर्याप्त संख्या में प्रवेश करना जरूरी है। उदाहरण के लिए, टायफायड, हैजा सरीखे रोगों का प्रवेश आहार नाल द्वारा होता है। डिप्थीरिया, यक्ष्मा और न्यूमोनिया के रोगजनकों को श्वसन मार्ग

से प्रवेश करना चाहिए। कुछ रोगजनक परपोषी कोशिका में कीटों के काटने या दंश के माध्यम से प्रवेश करते हैं। इस प्रकार का प्रवेश मार्ग प्राकृतिक रोध के कारण चुना गया।

(ङ) **संचरणीयता** : कोई रोगजनक किसी रोग की महामारी नहीं उत्पन्न कर सकता जब तक कि उसे संक्रमण करने के लिए सुग्राही व्यक्ति नहीं मिलते। अपने प्रभाव में हर प्रकार की महामारी स्वत: सीमा कारक होती है क्योंकि रोगजनक अंतत: उसी परपोषी को नष्ट कर देता है जो कि उसका पोषण करता है। इस तरह यदि रोगजनक संक्रमण के लिए नया परपोषी नहीं तलाश पाता तो उसके परपोषी की मौत का मतलब है खुद उसकी मौत।

इसलिए संचरणीयता महत्वपूर्ण है जो दो कारकों पर निर्भर करती है—परपोषी से रोगजनक (पैथोजन) की निकासी और सुग्राही (ससेप्टिबल) व्यक्ति की उपस्थिति। रोगजनक की निकासी परपोषी में संक्रमण की स्थिति पर निर्भर करती है। उदाहरण के लिए, टायफायड ज्वर का रोगजनक विष्टा के साथ और यक्ष्मा का रोग-जनक थूक के साथ निकलता है।

## संचरणीय रोगों का वर्गीकरण

जन स्वास्थ्य की दृष्टि से संचरणीय रोग सामान्यतया एक आदमी से दूसरे आदमी तक संचरण की विधि के आधार पर वर्गीकृत किए गए है। यह वर्गीकरण इस प्रकार किया जाता है—सम्पर्क से संचरित, हवा द्वारा संचरित, भोजन और पानी द्वारा सचरित, कीट द्वारा संचरित।

रोगकारी जीवों की प्रकृति के अनुसार संचरणीय रोगों को जीवाणविक (बैक्टीरियल), विषाणविक (वाइरल), प्रोटोजोआई, कृमीय और कवकीय वर्गों में बांटा जा सकता है।

## जीवाणु या बैक्टीरिया द्वारा होने वाले रोग

जीवाणुओं द्वारा होने वाले महत्वपूर्ण रोगों में जिन रोगों का विवेचन यहाँ किया जाएगा वे हैं हैजा, डिप्थीरिया, यक्ष्मा, कुष्ठ रोग, टिटेनस, टायफायड और प्लेग। इनमें से कुछ रोग तो बहुत आम हैं और कुछ कभी कभार ही होते हैं। कुछ महामारी के रूप में फैलते हैं और कुछ नहीं।

### हैज़ा (कॉलरा)

हमारे देश में मेलों के दौरान और बाढ़ आदि अन्य प्राकृतिक प्रकोपों के कारण हैज़ा महामारी के रूप में फैलता है। हैज़ा का रोग बहुत पुराने समय से जाना हुआ रोग है, जो बहुत नुकसान पहुँचाता रहा है। उष्मायन अवधि (इनक्यूबेशन पीरियड) यानी शरीर के अन्दर जीव के प्रवेश से लेकर लक्षणों के प्रकट होने तक की अवधि सामान्यतया कुछ घंटों से लेकर दो या तीन दिन होती है।

इसके लक्षण हैं वमन या कै, बहुत अधिक दस्त और पेशीय ऐंठन। पाखाना 'चावल के पानी' जैसा दिखलाई देता है। इन लक्षणों के परिणामस्वरूप निर्मलीकरण (डीहाइड्रेशन), खनिजों की हानि और रोग की उग्र अवस्था में तो मृत्यु तक हो जाती है।

इसका रोगकारी जीव है **विब्रियो कॉमा**, जो ग्रैम-अग्राही (ग्रैम-निगेटिव) बैक्टीरिया है। इसका संचरण संदूषित भोजन और जल के माध्यम से होता है। इसकी रोकथाम के मुख्य उपाय हैं—भोजन को खूब गरम करना, पानी को उबाल कर पीना, मल पदार्थ का उचित निपटान और पीने के पानी के स्रोत की सुरक्षा।

रोगकारी जीव को मारकर वैक्सीन तैयार करके सक्रिय रूप से प्रतिरक्षा की जाती है। वैक्सीन को हमेशा ही लेते रहना चाहिए, विशेषकर उस क्षेत्र में यात्रा करते समय जहाँ कि यह रोग हो रहा हो या महामारी के फैलने के दौरान। लेकिन उचित प्रकार की स्वच्छता रखना एक उत्तम नियंत्रण उपाय है क्योंकि अर्जित की गई प्रतिरक्षा केवल थोड़ी ही अवधि तक चलती है।

### डिप्थीरिया

डिप्थीरिया एक भयानक रोग है जिसमें गले में एक अर्धठोस पदार्थ रिसकर निकलता है और जो कि एक कड़ी झिल्ली में बदल जाता है। इसमें सामान्यतया रोग की उग्र प्रतिक्रिया स्वरूप शरीर में रोगकारी जीवों द्वारा उत्पन्न आविष (टॉक्सिन) के प्रति अनुक्रिया होती है।

रोग प्रायः सम्पर्क के दो से लेकर पाँच दिन के अन्दर पनपता है। हो सकता है कि रोग के आरम्भिक लक्षण उग्र न हों, जैसे कि हल्का ज्वर, खराब गला और सामान्य अस्वस्थता का महसूस किया जाना। लेकिन बाद में लक्षण बहुत उग्र हो सकते हैं और कई गड़बड़ियाँ हो सकती हैं। इनमें कुछ लक्षण हैं—गले में कड़ी झिल्ली बनने के कारण अवरोध हो जाने से सांस लेने में कठिनाई होना, सूजन और शोथ (इनफ्लैमेशन)। ऐसी गड़बड़ियाँ होने पर शल्यकर्म जरूरी हो सकता है। यदि डिफ्थीरिया करने वाले जीवों द्वारा हृदय पर आक्रमण होता है तो हृदय का बड़ी तेजी से घातक अवरोध हो सकता है।

यद्यपि डिफ्थीरिया अधिकांशतया बच्चों में ही होता है लेकिन यह रोग बड़ों पर भी आक्रमण कर सकता है। यदि रोग का उपचार काफी जल्दी शुरू कर दिया जाता है तो वह कारगर होता है। लक्षणों के प्रकट होने के पहले 12 से 24 घंटों में जब डिफ्थीरिया-प्रति-आविष (ऐन्टी-टॉक्सिन) दिया जाता है तो वह उत्पन्न आविष या टॉक्सिन को पूरी तरह से निष्प्रभावित कर देता है और रोगी को गम्भीर क्षति से बचा लेता है। यदि यह 24 घंटे बाद दिया जाता है तो अधिकतम मात्रा भी रोगी को रोग की उग्रता या मृत्यु से नहीं बचा सकती। यह प्रति-आविष या ऐन्टीटॉक्सिन इंजेक्शन के रूप में प्रायः एक मात्रा में दिया जाता है। यद्यपि पेनीसिलिन और अन्य प्रति जैविक पदार्थ (ऐन्टिबायोटिक) अच्छा असर दिखला सकते हैं, लेकिन पहला उपचार प्रति-आविष का इंजेक्शन देना ही होता है।

बच्चों को जब डिफ्थीरिया से प्रतिरक्षित किया जाता है तो यह प्रतिरक्षा (इम्म्यूनिटी) पूरे जीवन नहीं चलती। अब तो इस बात का प्रचलन हो गया है कि बच्चों को टिटेनस और कुकुरखाँसी (हूपिंग कफ) के साथ ही डिफ्थीरिया से भी प्रतिरक्षित कर दिया जाता है। कई प्रकार से गुणकारी यह वैक्सीन या दवा इन तीनों रोगों से बच्चों को एक साथ प्रतिरक्षित कर देती है। प्रौढ़ को डिफ्थीरिया से प्रतिरक्षित करना काफी कठिन काम है। फिर भी टॉक्सॉयड की छोटी मात्राएँ प्रौढ़ों के लिए उपयुक्त साबित होती हैं।

## यक्ष्मा (ट्यूबरकुलोसिस)

यक्ष्मा के जीवाणु (बैक्टीरिया) शरीर के किसी भी भाग पर आक्रमण करके ऊतकों को नष्ट कर सकते हैं। फेफड़े इस जीवाणु के सुग्राही संक्रमण स्थल हैं। ये ट्यूबरकुलिन नामक आविष (टॉक्सिन) उत्पन्न करते हैं। रोग की उग्र अवस्था वाले रोगी के नाक और गले से विसर्जित पदार्थों से ही अधिकांशतया यह रोग फैलता है। फुप्फुसीय (पल्मोनरी) या फेफड़ों की यक्ष्मा के लक्षण हैं—ज्वर या बुखार, खांसी, थूक में खून, छाती में दर्द और शरीर के वज़न में कमी।

यक्ष्मा का वास्तविक निदान धनात्मक ट्यूबरकुलिन परीक्षण, छाती के एक्स-रे, धनात्मक थूक, जठरीय पदार्थों के विश्लेषण और गिनी पिग के टीके के आधार पर किया जाता है। यक्ष्मा आनुवंशिक या पैतृक रोग नहीं है। यक्ष्मा के आधुनिक उपचार में छह मुख्य कारक हैं—आराम, आहार, दवाएँ, शल्यकर्म, स्वास्थ्य लाभ और स्वास्थ्य शिक्षा। बी॰ सी॰ जी॰ के टीके से रोग के प्रति काफी सुरक्षा रहती है। इसकी वैक्सीन या दवा का इंजेक्शन त्वचा में दिया जाता है। रोग के नियंत्रण के लिए अन्य उपाय भी किए जाते हैं। जन स्वास्थ्य और आयुर्विज्ञान के विशेषज्ञों की चेतावनी है कि बी॰ सी॰ जी॰ का टीका अन्य उपायों के बदले में नहीं बल्कि उनके संपूरक उपाय के रूप में इस्तेमाल किया जाना चाहिए। यक्ष्मा के सम्पर्क में निरन्तर कार्य करने वालों को यानी नर्सों, आयुर्विज्ञान के विद्यार्थियों, अस्पताल के कर्मचारियों और रेजिडेन्ट चिकित्सकों को यक्ष्मा के प्रति प्रतिरक्षित कर लिया जाना चाहिए।

## कुष्ठ रोग (लेप्रोसी)

यह कुष्ठ के बैसिलस (बैक्टीरिया) द्वारा होने वाला एक चिरकारी (क्रोनिक) संचरणीय रोग है। इस रोग की विशेषताएँ हैं—त्वचा के विक्षतों (लेजन), और परिधीय तंत्रिकाओं (पेरीफेरल नर्व) का प्रभावित होना जिससे संक्रमित क्षेत्र सुन्न हो जाता है। इसके अलावा अन्य लक्षण हैं—व्रण या अल्सर, ग्रंथिकाएँ या गाँठें, शल्की कच्छु (स्कैली स्कैब), अंगुलियों व पादांगुलियों की विरूपता (डिफॉर्मिटी) तथा शरीर के भागों का क्षय।

रोग तभी संचरणीय होता है जब रोगी भागों के साथ लम्बे समय तक सम्पर्क रहता है। लेकिन यह रोग

अधिकांश संचरणीय रोगों से अधिक भयानक है क्योंकि यह सामाजिक कलंक से सम्बंधित है। रोगी के रोग-मुक्त हो जाने के बाद भी उसका पुनर्वास करना बहुत कठिन होता है। इसलिए लोगों को इस रोग की वास्तविक प्रकृति के बारे में शिक्षित करना बहुत जरूरी है।

**धनुस्तम्भ (टिटेनस)**

यह एक गम्भीर रोग है जो घाव के प्रत्यक्ष अथवा अप्रत्यक्ष संरोपण (इनॉक्युलेशन) से संचरित होता है। इसकी ऊष्मायन-अवधि (इनक्यूबेशन पीरियड) सामान्यतया तीन से चार हफ्ते होती है।

इसका लक्षण है—पेशियों में पीड़ा देने वाला संकुचन (प्राय: गर्दन और जबड़े की पेशियों का), जिसके बाद वक्ष की पेशियों का अंगघात या पैरालिसिस हो जाता है और अन्ततः जिसमें प्राय: मृत्यु भी हो जाती है। इसी लक्षण के कारण इसे 'लॉक जॉ' या धनुस्तम्भ या धनुष्टंकार भी कहते हैं।

इसका कारणात्मक या रोगकारी जीव **क्लोस्ट्रीडियम टिटेनी** है। यह जल में घुलनशील आविष (टॉक्सिन) उत्पन्न करता है जो शरीर में परिसंचरित होता रहता है। जब कभी घाव रोगजनक (पैथोजेन) से संदूषित होता है तभी संक्रमण हो जाता है। यह एक आदमी से दूसरे आदमी में संचरित नहीं होता और संक्रमण केवल प्रत्यक्ष सम्पर्क से ही होता है। कभी भी सड़क दुर्घटना में घाव होने पर या गन्दी वस्तुओं, सड़क की धूल या प्राणियों की विष्टा से चोट के कटे भागों के संदूषित होने पर प्रति-टिटेनस (ऐन्टि-टिटेनस) टाक्साइड का इंजेक्शन लगवा लेना चाहिए।

अब यह आम प्रचलन हो गया है कि शिशुओं को टिटेनस, डिप्थीरिया और कुकुर खाँसी (हूपिंग कफ) से प्रतिरक्षित कर दिया जाता है। लेकिन हर तीसरे और पाँचवे साल के बाद फिर से प्रतिरक्षित करना भी जरूरी होता है।

**टायफायड**

टायफायड-ज्वर की विशेषता है लगातार बुखार का बने रहना जिसमें प्राय: सन्निपात (डेलीरियम), मन्द नाड़ी, उदरीय मृदुता और गुलाबी रंग का उद्गार या दाने होते हैं। टायफायड-ज्वर आंत्र द्वारा विसर्जित पदार्थों से फैलता है। कोई भी व्यक्ति जिसके आंत्र-पथ में टायफायड ज्वर के रोगाणु (जर्म) होते हैं वह औरों में रोग फैला सकता है भले ही वह व्यक्ति खुद रोग से पीड़ित न हो। ऐसे व्यक्तियों को **स्वस्थ रोगवाहक** कहा जाता है।

इसके अतिरिक्त प्रत्येक व्यक्ति जो रोग से पीड़ित होता है वह तो औरों में रोग फैला ही सकता है। मुख्यतया यह संदूषित जल और भोजन से फैलता है।

टायफायड-ज्वर या मियादी बुखार का निदान रोगी की आंत्र द्वारा विसर्जित पदार्थ में रोगकारी जर्म के प्रयोगशाला परीक्षण से किया जाता है। हाल के कुछ वर्षों से शल्य कर्म द्वारा पित्ताशय (गॉल ब्लैडर) को निकाल कर टायफायड वाहकों (कैरियर) का उपचार करने के प्रयत्न किए गए हैं क्योंकि इसमें जर्म या रोगाणु जमा होते रहते हैं। इसके अलावा क्लोरोमाइसिटिन सरीखे प्रति-जैविकों (एन्टिबायोटिक) से भी उपचार किया जाता है।

टायफायड-ज्वर का बचाव व रोकथाम उचित सामुदायिक स्वच्छता, जल की सुरक्षा, मक्खियों के संदूषण से भोजन की रक्षा, और व्यक्तिगत स्वच्छता पर आधारित है। किसी भी उम्र में रोग की महामारी या बाढ़ व तूफान सरीखे प्रकोप के दौरान टायफायड ज्वर के प्रति प्रतिरक्षीकरण किया जा सकता है। प्रतिरक्षीकरण उस समय भी किया जा सकता है जब रोग के वाहक से सम्पर्क हो रहा हो।

**प्लेग (ताऊन)**

भारत में प्लेग सन् 1895 में हांगकांग से आने वाले जहाजों द्वारा लाया गया। भारत में सभी को प्लेग के संचरण और नियंत्रण की विस्तृत जानकारी होनी चाहिए। प्लेग का जीवाणु (बैक्टीरिया) पिस्सुओं पर परजीवी के रूप में रहता है जो कि चूहों, मूषकों, और अन्य कृन्तकों (रोडेन्ट) पर रहता है। खून चूसने वाले पिस्सू एक चूहे से दूसरे चूहे में रोग का संचरण करते हैं। मानव में रोग पिस्सू के काटने या दंश से या संक्रमित चूहों के आकस्मिक संपर्क से फैलता है।

प्लेग के उपचार में सल्फा औषधियों और स्ट्रेप्टोमाइसिन का इस्तेमाल किया जाता है। प्लेग के नियंत्रण

उपायों में अब परिवर्तन हो गया है क्योंकि अब व्यक्ति को टीका न लगाकर जहाजों को चूहारोधी बनाया जाता है और चूहों व पिस्सुओं का नाश किया जाता है। आज के अधिकांश पानी के जहाज अब चूहारोधी होते हैं।

विश्व स्वास्थ्य संगठन (डब्ल्यू० एच० ओ०) ने मत व्यक्त किया है कि प्लेग का टीका व्यक्ति के लिए लाभदायक हो सकता है लेकिन अन्तर्राष्ट्रीय संगरोध व्यवहार (क्वारन्टाइन प्रैक्टिस) में इसको स्थान नहीं दिया गया है। आजकल प्लेग के टीकों की सिफारिश केवल रोग की महामारी के दौरान ही की जाती है।

## विषाणुओं (वाइरस) द्वारा होने वाले रोग

विषाणुओं द्वारा होने वाले कुछ महत्वपूर्ण रोगों का वर्णन नीचे किया जाता है :

### छोटी माता या चेचक (चिकन पॉक्स)

छोटी माता एक विषाणु (वाइरस) द्वारा होती है और यह रोग एक व्यक्ति से दूसरे व्यक्ति में सीधे ही या संक्रमित व्यक्ति द्वारा विसर्जित पदार्थ से दूषित कपड़ों या अन्य वस्तुओं के सम्पर्क से संचरित होता है। दाने या लाली दिखाई देने के दो दिन पहले से लेकर बाद में 14 दिन तक संक्रमित व्यक्ति छोटी माता का संचरण कर सकता है। छोटी माता के एक बार के आक्रमण से सामान्यतया रोग के प्रति स्थायी प्रतिरक्षा हो जाती है।

सबसे पहले त्वचा के उद्गार या दाने प्रकट होते हैं। लेकिन यह उद्गार एक साथ ही प्रकट नहीं होता बल्कि चरणवार या अलग-अलग अवस्थाओं में होता है। रोग की अवधि और उग्रता इस प्रकट होने वाले उद्गार पर निर्भर करती है। उग्र अवस्था में लगभग सारा शरीर ही दानों से भर सकता है। इसकी रोकथाम का उपाय यही है कि रोगी को बिल्कुल पृथक रखा जाय। जब तक सारी पपड़ी गिर नहीं जाती तब तक उसे सभी सार्वजनिक स्थानों से अलग रखा जाय। उद्गार या दानों पर कैलामाइन लोशन लगाया जा सकता है। रोगी को, उसके बिस्तर को और कपड़ों को बिल्कुल स्वच्छ रखा जाना चाहिए।

### खसरा (मीजल्स)

खसरा (मीजल्स) या रूबिओला की विशेषता है कि इसमें ज्वर, श्वसन पथ की श्लेष्मल झिल्ली (म्यूकस मेम्ब्रेन) का शोथ (इनफ्लैमेशन), प्रकाश के प्रति आँखों की संवेदनशीलता, भूख की कमी, कै, और त्वचा में उद्गार या दाने (रैश) होते हैं। व्यक्ति को खसरा हो जाने पर रोग का आक्रमण लगभग दस से बारह दिन तक चलता है।

इसका एक निरोधी उपाय है—गामा ग्लोबुलिन का टीका। इस पदार्थ से मंद प्रतिरक्षा स्थापित हो जाती है जो करीब तीन हफ्ते तक चलती है। अधिकांशतया छह महीने से कम उम्र वाले शिशुओं को गामा ग्लोबुलिन की आवश्यकता नहीं होती यदि माताओं को खसरा हुआ रहता है क्योंकि बच्चा माता से कुछ मंद प्रतिरक्षा अर्जित कर लेता है।

### पोलियो-मेरुरज्जुशोथ (पोलियो माइलिटिस)

पोलियो-मेरुरज्जुशोथ शरीर का एक सामान्य रोग है जो विषाणु या वाइरस द्वारा होता है। व्यक्ति जब इस रोग से पीड़ित होता है तो तंत्रिकातंत्र (नर्वस सिस्टम) के विभिन्न भागों का शोथ (इनफ्लैमेशन) हो जाता है। मेरुरज्जु (स्पाइनल कॉर्ड) की बड़ी प्रेरक (मोटर) कोशिकाएँ इससे क्षति के प्रति अधिक सुग्राही होती हैं। ऐच्छिक पेशियों (वॉलन्टरी मसल) का अंगघात या फालिज हो जाता है। कुछ वर्ष पहले तक पोलियो-मेरुरज्जुशोथ को केवल शिशु अवस्था और बाल्यावस्था का ही रोग समझा जाता था। इस कारण इसे शैशव अंगघात कहा जाता था। लेकिन अब पता चला है कि यह रोग किसी भी अवस्था में हो सकता है।

आधुनिक खोजों के आधार पर प्रमाण मिले हैं कि पोलियो-मेरुरज्जुशोथ मुख्य रूप से आंत्र द्वारा विसर्जित पदार्थों से होता है। लेकिन यह संदूषित भोजन या पेय और मक्खियों अथवा अन्य कीटों के द्वारा भी फैल सकता है जो कि भोजन या पेय को संदूषित करते हैं।

पोलियो-मेरुरज्जुशोथ के चिह्न और लक्षण रोग की उग्रता पर निर्भर करते हैं। कम उग्र अवस्था में बीमारी एक से लेकर कई दिन तक चलती है। लेकिन अधिक उग्र या अंगघात प्रकार की अवस्था में बीमारी लम्बे समय तक चलती है और ज्वर बहुत अधिक दिनों तक चलता रहता है। केन्द्रीय तंत्रिका-तंत्र पर प्रभाव पड़ने का आरम्भिक लक्षण है आपेक्षिक रूप से सिर को

आगे की ओर न मोड़ पाना। गर्दन का अकड़ जाना भी महत्वपूर्ण लक्षण है। अंगघात या फालिज विशेष पेशियों की दुर्बलता के रूप में शुरू होता है। दो से तीन दिन के अन्दर यह अंगघात अपनी चरम पराकाष्ठा पर पहुँच जाता है। अधिकांशतया पहले अंगघात नहीं होता। यदि यह होता है तो ठीक होने की काफी अधिक संभावना रहती है।

पोलियो-मेरुरज्जुशोथ की वैक्सीन अब निरापद और प्रभावकारी साबित हो गई है। आजकल पोलियो मेरुरज्जुशोथ, डिप्थीरिया, टिटेनस और कुकुर खाँसी के प्रति सुरक्षा के लिए अनेक प्रभाव वाली वैक्सीन का प्रयोग किया जाता है।

### अलर्क या रैबीज

यह एक विषाणु या वाइरस रोग है जो मानव में रैबिड प्राणियों विशेषकर कुत्तों, के काटने से संचरित होता है। इसकी ऊष्मायन अवधि (इन्क्यूबेशन पीरियड) 10 दिन से लेकर कई महीने होती है।

इसके लक्षण हैं तेज सिरदर्द और तेज बुखार जिसमें उत्तेजना और निराशा की एकान्तर (आल्टर्नेट) अवस्थाएँ होती हैं। रोगी को द्रव को निगलने तक में कठिनाई होती है। गले व छाती में तीव्र पेशीय ऐंठन होती है। अंगघात और ऐंठन के बाद रोगी बड़ी दर्दनाक मौत से मरते हैं। रैबीज या अलर्क को 'हाइड्रोफोबिया' या 'जलभीति' भी कहते हैं।

यह रोग एक आदमी से दूसरे आदमी में संचरित नहीं होता और केवल रैबिड या रैबीज वाले कुत्तों के काटने से संचरित होता है। प्रमुख नियंत्रण उपाय है कुत्तों का अनिवार्य प्रतिरक्षीकरण।

रैबीज (अलर्क) के उपचार की खोज सर्वप्रथम लुई पास्तेर ने की थी और इसलिए इसे **पास्तेर उपचार** कहते हैं। इसमें 14 दिन तक रोज क्रम से एक इंजेक्शन दिया जाता है। यह इंजेक्शन "स्थिरीकृत वाइरस" (फिक्स्ड वाइरस) से तैयार किया जाता है। यह प्रतिरक्षी (ऐन्टिबौडी) के निर्माण को उत्प्रेरित करता है। कोई भी व्यक्ति जो आवारा कुत्ते के द्वारा काटा जाता है उसे निरोधी उपाय के रूप में यह उपचार करा लेना चाहिए।

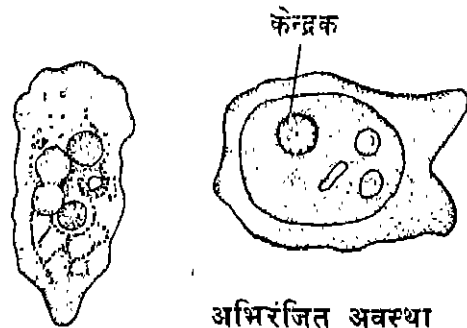
## आदि जन्तुओं या प्रोटोज़ोआ द्वारा उत्पन्न होने वाले रोग

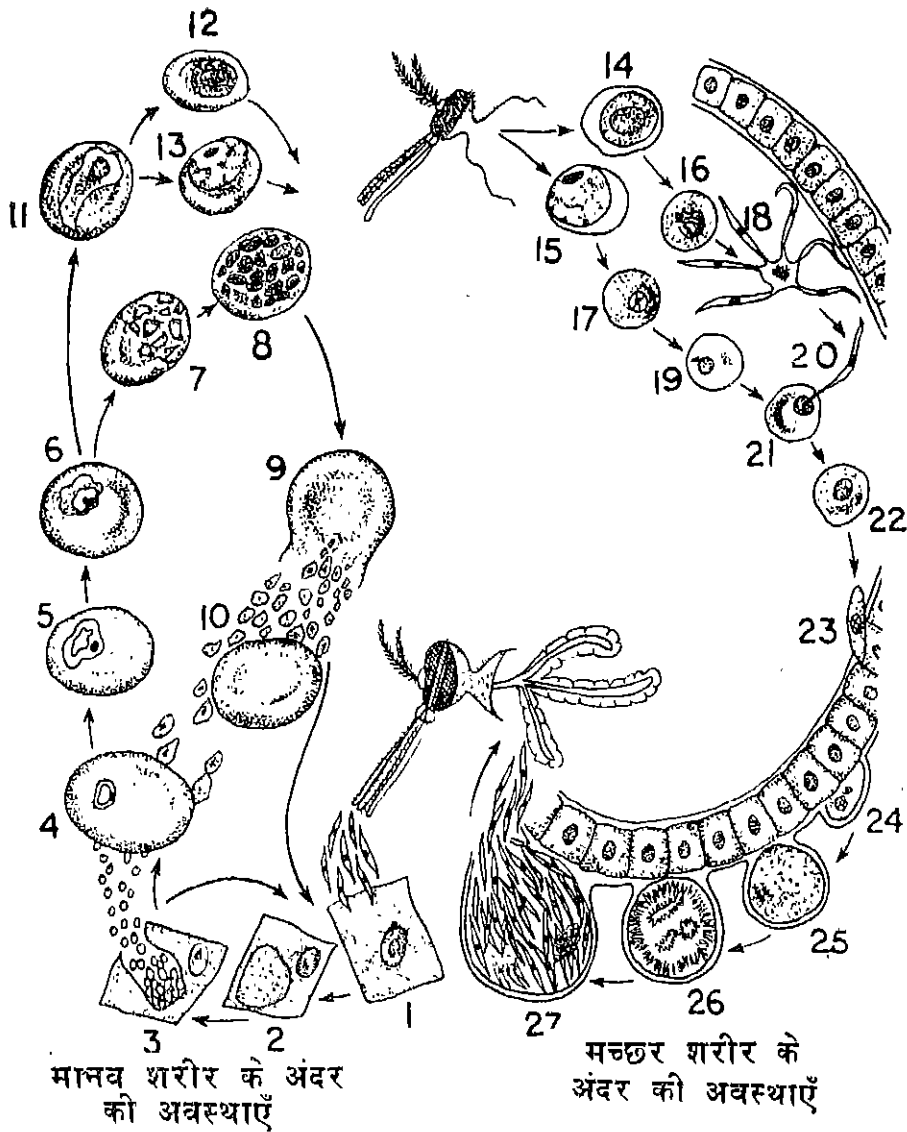
प्रोटोज़ोआ द्वारा कई रोग होते हैं और इनमें सबसे आम रोग हैं मलेरिया और अमीबता या अमीबिऐसिस।

### अमीबता (अमीबिऐसिस)

प्रोटोज़ोआ के कई जन्तु आंत्र-रोग उत्पन्न करते हैं जो संदूषित भोजन व पेयों के द्वारा संचरित होते हैं। इनमें से सबसे अधिक महत्वपूर्ण अमीबी पेचिश है क्योंकि यह बहुतायत से होती है। उग्र संक्रमण में ऊष्मायन या इन्क्यूबेशन अवधि पाँच दिन और चिरकारी (क्रोनिक) अवस्था में यह कई महीनों की होती है।

इसके लक्षणों में मुख्य हैं दस्त (डायरिया) और एकान्तर रूप से कब्ज का होना। उग्र अवस्था में पेचिश और विष्टा के साथ श्लेष्मा (म्यूकस) तथा खून आता है। यकृत या कलेजे और फेफड़ों में विद्रधि (ऐब्सेस) उत्पन्न हो सकते हैं।

कारणात्मक या रोगकारी जीव एन्टअमीबा हिस्टोलिटिका है (चित्र 35.1)। इसका संक्रमण सिस्टों

चित्र 35.1 : एन्टअमीबा हिस्टोलिटिका।

(पुटियों) द्वारा होता है जो संक्रमित विष्टा वाले व्यक्तियों की विष्टा में होती हैं। संदूषित कच्ची सब्जियाँ, फल और अन्य भोजन पदार्थ तथा संदूपित जल रोग का संचरण करते हैं। विष्टा या मल पदार्थ के उचित निपटान,

चित्र 35.2 : मलेरिया परजीवी (प्लैज्मोडियम वाइवैक्स) का जीवन चक्र। 1-13 : मानव के शरीर के अन्दर की अवस्थाएँ। 1-3 में दिखाया गया है कि यकृत कोशिका में परजीवी कैसे वृद्धि करता है, 4-10 में लाल रुधिर कणिका में जीवन-चक्र दिखलाया गया है। परजीवी लाल रुधिर कणिका में गुणित होता है, उसे तोड़ता है और नई ला० रु० क० पर आक्रमण करता है। 11-13 में लैंगिक रूप वाली अवस्था में मलेरिया-परजीवी की वृद्धि दिखलाई गई है। चूसने के दौरान लैंगिक अवस्था में परजीवी मच्छर के अन्दर पहुँच जाता है। 14.27 : मच्छर के अन्दर की अवस्थाएँ। 14-19 में नर और स्त्री युग्मकों (गैमीट) का परिवर्धन दिखलाया गया है। 20-22 : नर और स्त्री युग्मकों का संलयन या सम्मिलन तथा युग्मनज (जाइगोट) का बनना, 23 : मच्छर की आहार-नाल में चलयुग्मनज (ऊकिनेट) का प्रवेश, 24-27 : बीजाणुज (स्पोरोजोआइट) में चलयुग्मनज की वृद्धि। बीजाणुज मानव के शरीर में मच्छर के काटने से पहुँचते हैं।

। की सुरक्षा और वातावरणी स्वच्छता से रोग का बचाव किया जा सकता है ।

इस रोग के प्रतिरक्षीकरण की कोई भी विधि नहीं है ।

## मलेरिया

मलेरिया मानव का सबसे पुराना और सबसे अधिक विनाशी रोग है । पहले अनूप (स्वैम्प) और कच्छ (मार्श) की गंदी वायु को इस रोग का कारण समझा जाता था इसीलिए इस रोग का नाम मलेरिया पड़ा । अभी भी यह दुनिया की सबसे गंभीर स्वास्थ्य समस्या बना हुआ है, विशेषकर ऊष्णकटिबंधी प्रदेशों की ।

रोगकारी जीव प्लैज्मोडियम वंश (जीनस) का एक-कोशीय जीव है । रोग की ऊष्मायन अवधि प्लैज्मोडियम की विभिन्न जातियों के अनुसार भिन्न-भिन्न होती है । **पै० फैल्सीपैरम** में ऊष्मायन अवधि करीब 12 दिन, पै० **वाइवैक्स** में 13-15 दिन और पै० **मलेरियाई** में 28-30 दिन की होती है । रोग का संचरण एक आदमी से दूसरे आदमी में मादा **एनोफेलीज** मच्छर के द्वारा होता है ।

मलेरिया-परजीवी का जीवन-चक्र बहुत अधिक जटिल है । चित्र 35.2 में इसके सम्पूर्ण जीवन-चक्र को दो परपोषियों — मानव और मच्छर में दिखलाया गया है । मच्छर को मध्यस्थ या मध्यवर्ती (इण्टरमीडिएट) परपोषी कहा जाता है (कीट रोगवाहक) । बहुत अधिक समय तक मलेरिया का होना मच्छर से जोड़ा जाता था । सन् 1880 में लैवर्न ने सर्वप्रथम मलेरिया के पीड़ित रोगी की लाल रुधिर कोशिकाओं में प्लैज्मोडियम का निरीक्षण किया । लेकिन मलेरिया परजीवी के जटिल जीवन-चक्र का पता लगाने का श्रेय सर रोनाल्ड रौस को हैं । उन्हें सन् 1902 में इस कार्य के लिए नोबल पुरस्कार दिया गया था ।

अपने जीवन चक्र की जटिलता के कारण ही मलेरिया स्वास्थ्य सम्बन्धी गंभीर समस्या है ।

इस रोग के लक्षणों की विशेषता है कंपकंपी वाले जाड़े के साथ तेजी से शरीर के तापमान में वृद्धि और सिरदर्द तथा मतली । बहुत अधिक पसीना होने के बाद बुखार उतर जाता है । ज्वर, जाड़े और पसीने की पुनरा-वृत्ति होती रहती है । तेज जाड़े व कंपकंपी तथा ज्वर के दौरान स्लाइड पर रुधिर के आलेप (स्मीयर) के सूक्ष्म निरीक्षण से रोग की सही पहचान हो जाती है । पूरे और ठीक उपचार की प्रभावकारी औषधियाँ हैं क्लोरोक्विन और प्राइमाक्विन ।

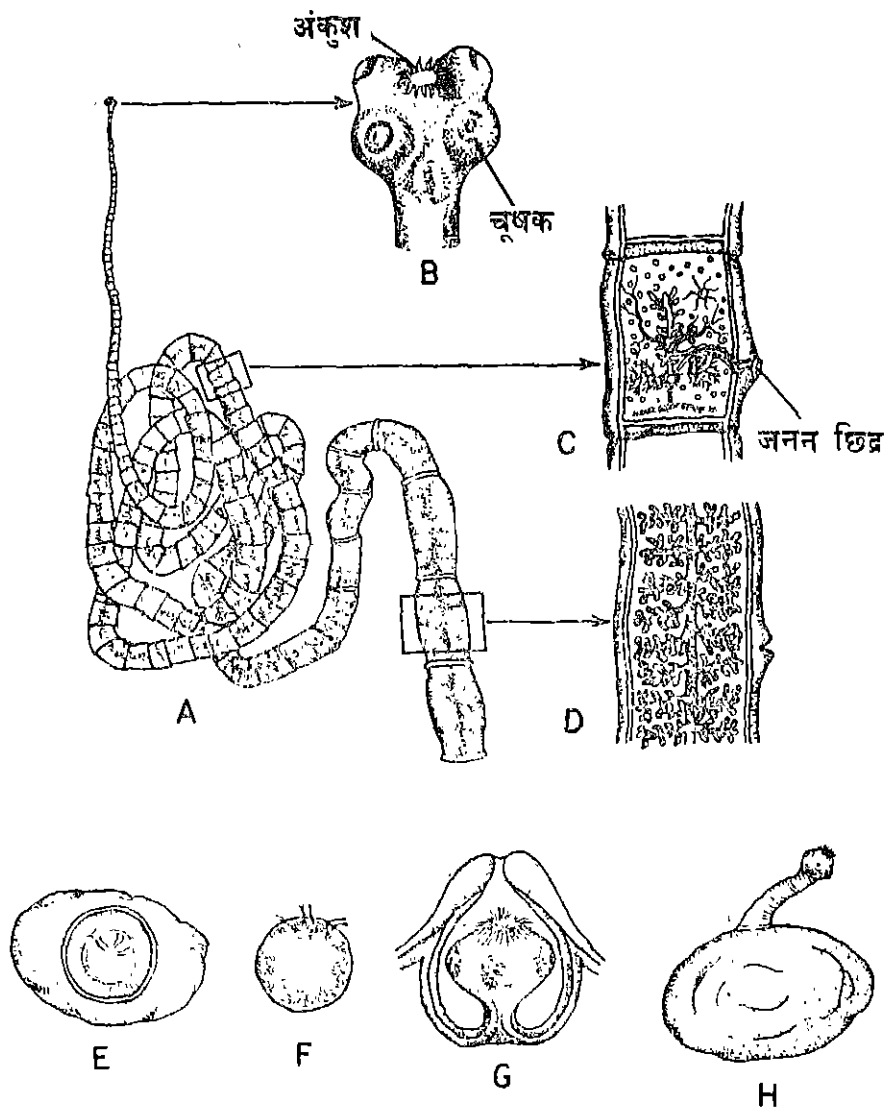
मलेरिया का प्रतिरक्षीकरण नहीं होता । बचाव और नियंत्रण उपाय यही है कि कीट रोगवाहक (वेक्टर) यानी मच्छर का उन्मूलन किया जाय । दीवारों पर डी डी टी का छिड़काव और तालाबों, पोखरों, गलियों में तेल की परत के छिड़काव से मच्छरों के प्रजनन पर रोक लग जाती है । विश्व स्वास्थ्य संगठन (वर्ल्ड हैल्थ आर्गनाइ-जेशन — डबल्यू० एच० ओ०) के सहयोग से राष्ट्रीय मलेरिया उन्मूलन कार्यक्रम के अन्तर्गत हमारे देश में मलेरिया का नियंत्रण किया जा रहा है । पिछले कुछ सालों के दौरान मलेरिया काफी कम हो गया था लेकिन अब यह फिर उभरने लगा है । इस खतरनाक और हानिकारक रोग के नियंत्रण के लिए लोगों को चाहिए कि वे इन संस्थाओं या एजेन्सियों के साथ सहयोग करें ।

## कृमियों (हेल्मिंथ) द्वारा उत्पन्न होने वाले रोग

### फाइलेरिया

फाइलेरिया के कृमि (वर्म) मानव पर आक्रमण करने वाले परजीवियों में बहुत महत्वपूर्ण हैं । फाइलेरियता (फाइलेरिएसिस) शब्द का अर्थ है फाइलेरिया कृमियों द्वारा होने वाला संक्रमण । फाइलेरिया-कृमियों की कुछ जातियों के बार-बार संक्रमण से शरीर के कुछ भागों की काफी अधिक वृद्धि हो जाती है । उदाहरण के लिए, टाँगें ऐसी हो जाती हैं मानो वे हाथी की टाँगें हों और इसी कारण इस दशा को श्लीपद या फीलपाव (एलीफेन्टि-एसिस) कहा जाता है ।

इस को पैदा करने वाले कृमि का नाम है **वूकेरेरिया बैंक्रोफ्टी** । इन परजीवियों से संक्रमित मच्छर जब किसी आदमी को काटता है तो कृमि त्वचा के नीचे जमा होकर फिर लसीका-तंत्र (लिम्फेटिक सिस्टम) में पहुँच जाते हैं, जहाँ वे प्रौढ़ों में परिवर्धित हो जाते हैं । लसीका तंत्र में

रहते हुए प्रौढ़ मादाएँ भारी संख्या में छोटे छोटे डिम्भक (लार्वा) उत्पन्न करती हैं जिन्हें माइक्रोफाइलेरिया कहते हैं और जो रुधिर में इधर-उधर ले जाए जाते हैं। जब मच्छर की सही जाति इस अवस्था में अपने भोजन के रूप में खून चूसती है तो इनमें से कुछ डिम्भक भी उसके द्वारा चूस लिए जाते हैं, जो करीब दो हफ्ते में परिवर्धित होकर मानव को संक्रमित करने वाले परजीवी रूप में हो जाते हैं। ये मच्छर के मुखांगों (माउथ पार्ट्स) में रेंग कर पहुँच जाते हैं और फिर मच्छर के काटने पर मानव-परपोषी की त्वचा में पहुँच जाते हैं। त्वचा या चमड़ी को बेधने के

चित्र 35.3 : A : टीनिया सोलियम (बाहरी आकार)। B : सिर के क्षेत्र का आवर्धित दृश्य। C : लैंगिक दृष्टि से परिपक्व देहखंड। D : अंडों से भरा (ग्रेविड) देहखंड। E, F : गोलांकुण अवस्था। G : ब्लैडरवर्म अवस्था। H : सद्यःजात ब्लैडरवर्म।

बाद में लसीका पर्वों (लिम्फ नोड) में पहुँचकर वहीं परिपक्व होते हैं।

शरीर की विरूपता (डीफार्मिटी), लगता है, सालों साल इसके द्वारा बार-बार संक्रमण होने से ही होती है। ये कृमि लसीका-वाहिकाओं का प्राथमिक संकीर्णन या संकुचन (कन्स्ट्रिक्शन) कर देते हैं जिससे कुछ शोथ या सूजन भी होती है। इसके कारण क्षेत्र में प्रोटीन बहुत अधिक मात्रा में पहुँचने लगते हैं जिससे संयोजी ऊतक (कनेक्टिव टिश्यू) की बहुत अधिक वृद्धि हो जाती है।

लसीका-पर्वों पर प्रौढ़ कृमियों के पाये जाने पर या रुधिर में माइक्रोफाइलेरियाओं (सूत्राभों) की खोज करने पर धनात्मक निदान (डायग्नोसिस) किया जा सकता है। सामान्य फाइलेरियता (फाइलेरिएसिस) में कभी भी औषधीय चिकित्सा की आवश्यकता नहीं होती। रोग को फैलने से रोकने में जो दो औषधियाँ सहायता देती हैं वे हैं हैट्राजन और एम०एस०ई०। हैट्राजन रुधिर में माइक्रोफाइलेरियाओं का नाश करता है और एम०एस०ई० नामक यौगिक प्रौढ़ कृमियों का। परपोषी मच्छर का उन्मूलन भी बहुत महत्वपूर्ण है।

## फीता कृमि (टेप वर्म)

फीता कृमि नाम इसलिए पड़ा है कि यह कृमि लम्बे फीते की तरह दिखलाई देता है।

सामान्य फीता कृमि का वैज्ञानिक नाम **टीनिया सोलियम** है (चित्र 35.3)। यह मानव की आँत्र में अंतः परजीवी (एन्डोपैरासाइट) के रूप में रहता है। फीते का एक सिरा बहुत बारीक या कम चौड़ा होता है जिसमें कृमि का **सिर** होता है। सिर में प्याले की आकृति के चार **चूषक** (सकर) और मुड़े हुए **अंकुशों** (हुक) की एक पंक्ति होती है। ये अंकुश और चूषक मानव की आँत्र-भित्ति (दीवार) से चिपकने वाले अंगों के रूप में इस्तेमाल किए जाते हैं। शरीर धीरे-धीरे पश्च (पोस्टीरियर) या पिछले सिरे की ओर चौड़ा होता जाता है और मुख्य भाग रिब्बन जसा और खंडयुक्त (सेगमेन्टेड) होता है। सिर के एकदम बाद वाला भाग ग्रीवा या गर्दन कहलाता है जिसमें पश्च खंडों के निर्माण के लिए अलैंगिक प्रकार से अन्धाधुन्ध विभाजन (प्रोलिफेरेशन) होता है। इन पश्च खंडों में से प्रत्येक देहखंड या प्रोग्लॉटिड कहलाता है। एक पूर्ण परिवर्धित कृमि में देहखंडों की संख्या 800 से 900 तक होती है।

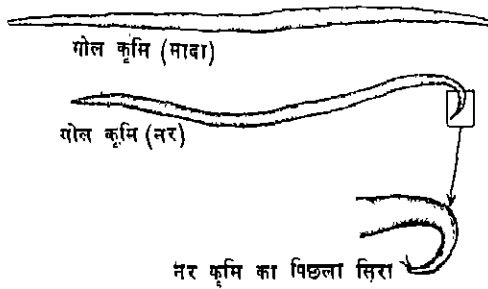
प्रत्येक देहखंड में नर और स्त्री जनन-अंग होते हैं। इस प्रकार टीनिया उभयलिंगी (हर्माफ्रोडाइट) जंतु है। इसमें स्व-निषेचन होता है अर्थात् अंडों का निषेचन उसी कृमि के शुक्राणुओं द्वारा होता है। निषेचित अंड स्त्री जनन-मार्ग में छह अंकुशों वाले भ्रूण (एम्ब्रियो) में परिवर्धित होकर एक मोटे कवच या खोल से ढक जाता है। इस अवस्था को गोलांकुश (औन्कोस्फियर) कहते हैं। अब इस अवस्था में इस गोलांकुश का यदि दूसरे परपोषी के शरीर में स्थानान्तरण नहीं होता तो इसका और आगे परिवर्धन नहीं होता। **टीनिया सोलियम** का दूसरा परपोषी सूअर है।

गोलांकुशों (औन्कोस्फियर) से भरा देहखंड कृमि के शरीर से अलग होकर विष्टा के साथ बाहर आ जाता है। फिर देहखंड टूट जाता है और गोलांकुश आस-पास बिखर जाते हैं। जब इनको सूअर की आहार-नाल में प्रवेश करने का मौका मिलता है तो इनकी मोटी भित्ति घुल जाती है। इस अवस्था में **षडंकुश (हेक्साकैंथ)** कहलाने वाला भ्रूण आहार-नली की दीवार को अपने अंकुशों से वेधकर रुधिर प्रवाह में पहुँच जाता है। अंततः यह सूअर की पेशियों में आ जाता है और पुटी वाला बन जाता है। इस पुटी या छोटी थैली जैसी रचना के अन्दर ही भ्रूण परिवर्धित होता है। इस अवस्था को ब्लैडरवर्म कहते हैं। इस ब्लैडरवर्म का परिवर्धन तब तक नहीं होता जब तक कि यह मानव के शरीर में स्थानान्तरित नहीं हो जाता। यह स्थानान्तरण तभी सम्भव है जब मानव अधूरे प्रकार से पकाया गया सूअर का गोश्त खाता है। मानव की आहार-नली में ब्लैडरवर्म सिर वाले अंश के साथ एक छोटे कृमि के रूप में निकलता है। यह आंत्र भित्ति से चिपक जाता है और फिर अलैंगिक प्रकार से पूरी लम्बाई वाले फीता-कृमि में परिवर्धित हो जाता है। इस प्रकार **टीनिया सोलियम** के दो परपोषी हैं— प्राथमिक परपोषी के रूप में मानव और द्वितीयक परपोषी के रूप में सूअर।

फीता कृमि के संक्रमण का तुरन्त यह असर होता है कि जठरीय गड़बड़ियाँ या पेट की गड़बड़ियाँ और

अरक्तता (ऐनीमिया) यानी खून की कमी हो जाती है। उग्र प्रकार के प्रभाव का परिणाम होता है आंत्र-अधिधारण (ऑक्लूज़न) या अवरोध। इसके लिए कई कृमिनाशी औषधियाँ उपलब्ध हैं, संक्रमण होने पर जिन्हें डाक्टर की सलाह से ही इस्तेमाल किया जाना चाहिए।

## गोल कृमि (राउन्ड वर्म)

मानव में पाये जाने वाले **गोल कृमि** को **ऐस्केरिस लम्ब्रिकॉइडीज** (चित्र 35.4) कहते हैं। यह अंतः

चित्र 35.4 : गोल कृमि (ऐस्केरिस)।

परजीवी है अर्थात परपोषी के शरीर के अन्दर रहता है और क्षुद्रांत्र या छोटी आँत (स्माल इन्टेस्टाइन) का संक्रमण करता है। जीवित अवस्था में गोल कृमि हल्का लाल पीला होता है लेकिन मृत अवस्था में दूधिया सफेद दिखता है। तीन ओष्ठों द्वारा घिरा मुँह अग्र (एन्टीरियर) या अगले भाग के अंतिम सिरे पर होता है। आहार-नाल का बाहर की ओर खुलने वाला द्वार गुदा (ऐनस) कहलाता है, जो पश्च सिरे पर स्थित होता है। इसमें नर और मादा अलग-अलग होते हैं अर्थात उभय-लिंगी नहीं। बाहर से निरीक्षण करने पर नर और मादा कृमियों को आसानी से अलग-अलग पहचाना जा सकता है। नर कृमियों में शरीर का गुदा के बाद वाला भाग नीचे की ओर एकदम काफी अधिक मुड़ा हुआ होता है लेकिन मादा कृमियों में यह बिल्कुल सीधा होता है। मादाएँ नर से बड़ी होती हैं और उनमें जनन-छिद्र पृथक होते हैं। नर में जनन-छिद्र पृथक नहीं होता, और आहार नाल के बाहर की ओर खुलने वाला द्वार ही जनन-छिद्र का भी कार्य करता है।

अंडों का निषेचन मादा के शरीर के अन्दर होता है और रोज करीब 20,000 अंड मुक्त किए जाते हैं। ये अंडे तो परपोषी के शरीर से विष्टा के साथ बाहर आ जाते हैं, लेकिन कृमि आँत में ही रहते हैं। प्रत्येक निषेचित अंड काइटिनमय कवच या खोल (शैल) से ढका होता है और भ्रूण का परिवर्धन करीब दो हफ्ते में पूरा होता है। ये अंड नए परपोषी के शरीर में भोजन और पेय पदार्थों के साथ पहुँच जाते हैं। नए परपोषी की आँत्र में पहुँचने के बाद ही अंडे फूटते हैं। आँत्र से डिम्भक विभिन्न अंगों में, जैसे यकृत, हृदय और फेफड़ों में, पहुँच जाते हैं। उनकी इस यात्रा के दौरान डिम्भक (लार्वा) प्रौढ़ बन जाते हैं और ये प्रौढ़ अंत में फिर आँत्र में पहुँचकर वहीं जम जाते हैं।

गोलकृमि के संक्रमण से आँत्र का अवरोध, यूस्टेकी नली (यूस्टेकियन ट्यूब) का अवरोध, ऊहुकपुच्छशोथ (अपेन्डिसाइटिस) और पर्युदर्याशोथ (पेरीटोनाइटिस) के रोग हो जाते हैं।

## अभ्यास

1. संचरणीय (कम्युनिकेबल) और असंचरणीय (नौन-कम्युनिकेबल) रोगों का अंतर स्पष्ट करो।
2. संचरणीय रोगों से लड़ने के लिये महत्वपूर्ण उपाय क्या हैं ?

3. संचरणीय रोगों को समझने और उनके नियंत्रण में परजीवीविज्ञान (पैरासिटोलॉजी); महामारी विज्ञान (एपीडीमियोलॉजी) और प्रतिरक्षा विज्ञान (इम्यूनोलॉजी) ने किस प्रकार सहायता पहुँचाई है ?
4. संक्रमण को कौन से कारक प्रभावित करते हैं ?
5. निम्नलिखित रोगों के चिह्न और लक्षण बतलाओ। इन रोगों के बचाव और नियंत्रण के लिये कौन-कौन से सामुदायिक स्वास्थ्य उपाय अपनाए गए हैं ?
   (क) हैजा (कॉलरा)।
   (ख) मलेरिया।
   (ग) यक्ष्मा (ट्यूबरकुलेसिस)।

# अध्याय-36

# सामुदायिक स्वास्थ्य

सामुदायिक स्वास्थ्य की परिभाषा इस प्रकार होगी— **'वे सभी क्रियाकलाप जो किसी समुदाय के स्वास्थ्य के सुधार में योग देते हैं।'**

अच्छा स्वास्थ्य बनाए रखने के लिए सामुदायिक स्वास्थ्य सेवाओं के अन्तर्गत कई क्रियाकलाप होते हैं, जो इस प्रकार हैं—(i) पीने के पानी की आपूर्ति तथा वाहित मल के निपटान द्वारा वातावरण की स्वच्छता बनाए रखना, (ii) संचरणीय रोगों की रोकथाम और नियंत्रण के लिए सुविधा प्रदान करना, जैसे टीका अभियान चलाना व रोगियों को पृथक कर उपचार करना, (iii) मातृ तथा शिशु स्वास्थ्य सेवाएँ प्रदान करना, (iv) स्कूल स्वास्थ्य शिक्षा, सामुदायिक स्वास्थ्य शिक्षा, पोषण शिक्षा और परिवार कल्याण की सुविधा देना।

सारणी 36.1 में स्वास्थ्य केन्द्रों द्वारा दी जाने वाली आधारभूत स्वास्थ्य सेवाएँ दी गई हैं। यद्यपि गाँवों और शहरों के स्वास्थ्य संगठन भिन्न-भिन्न प्रकार के हैं लेकिन दी जाने वाली आधारभूत सेवाएँ समान हैं।

इन सेवाओं के अतिरिक्त मलेरिया उन्मूलन तथा परिवार कल्याण नियोजन सरीखे राष्ट्रीय कार्यक्रम सरकारी कर्मचारियों और सरकारी पैसे की सहायता से चलते हैं।

## संचरणीय रोगों के सामान्य निरोधी उपाय

बहुत पुरानी कहावत है कि रोग के इलाज से बेहतर है उससे बचे रहना। संचरणीय रोगों के नियंत्रण के लिए पर्याप्त निरोधी उपाय करना जरूरी है। संचरणीय रोगों से पीड़ित व्यक्ति को चाहिए कि वह इस तरह से सावधानी बरते कि व्यक्ति से रोग समुदाय में न फैल सके। ऐसे रोगियों को पृथक करना और लोगों को रोग के प्रति सावधान करके तदनुसार उपाय करने की शिक्षा देना जरूरी है। इनमें से कुछ उपाय नीचे दिए गए हैं :

**टीका**—आजकल कई संचरणीय रोगों के टीके उपलब्ध हैं, जैसे कि चेचक, हैजा, टायफायड और यक्ष्मा के। संचरणीय रोगों को फैलने से रोकने के लिए प्रत्येक नागरिक का कर्तव्य है कि वह टीका लगवा ले। इस संदर्भ में हर एक का यह कर्त्तव्य होना चाहिए कि वह सामुदायिक स्वास्थ्य कार्यकर्त्ताओं को पूरा सहयोग दे।

**स्वच्छता**—संचरणीय रोगों से लड़ने के लिए जरूरी है कि स्रोत पर ध्यान दिया जाय। अस्वच्छ या गन्दे पास-पड़ोस से ही रोग पनपते हैं। पीने को प्रदूषित (पौल्यूटेड) और संदूषित (कन्टैमिनेटेड) पानी, मक्खियों और मच्छर के प्रजनन को बढ़ावा देने वाला इधर-उधर फेंका हुआ कूड़े-कचरे का ढेर तथा धूल और मक्खियों के लिए खुला छूटा हुआ भोजन आदि ऐसे मुख्य स्रोत हैं जहाँ रोगकारी जीव शरण लेकर पनपते हैं। वातावरण की स्वच्छता बनाए रखने के लिए स्वच्छता सम्बन्धी कार्यकर्त्ताओं की मदद की जाती रहनी चाहिए जिससे रोगों का प्रसार रुका रहेगा।

## सारणी 36.1

### स्वास्थ्य केन्द्रों द्वारा दी जाने वाली आधारभूत स्वास्थ्य सेवाएँ

| चिकित्सा-सेवा | स्वास्थ्य शिक्षा | जन्म-मरण के आँकड़े |
|---|---|---|
| 1. उपचार करना तथा रोगी व्यक्तियों को अस्पताल में रखना<br>2. रोगी विशिष्ट अस्पतालों में भेजे जाते हैं | 1. व्यक्तिगत सम्पर्क<br>2. छपी सामग्री<br>3. दृश्य-श्रव्य सहायक उपकरण | 1. एकत्रीकरण<br>2. क्रॉस-जाँच |

| वातावरणी स्वच्छता | संचरणीय रोगों की रोकथाम व नियंत्रण | मातृ तथा शिशु सेवा तथा परिवार नियोजन | स्कूल स्वास्थ्य सेवाएँ |
|---|---|---|---|
| 1. स्वच्छ जल की आपूर्ति ।<br>2. मल पदार्थ का निपटान—कम्पोस्ट गड्ढों, सोक पिटों, आँगन बाड़ियों (किचन गार्डन), शौचालयों, धुआँ रहित चूल्हों द्वारा ।<br>3. कीटों के प्रजनन-स्थलों से बचाव ।<br>4. वायु प्रदूषण से बचाव । | 1. चेचक के टीके सामूहिक रूप से; हैजा के टीके व अन्य टीके ।<br>2. मलेरिया का उन्मूलन<br>3. कुष्ठ रोग, ट्रैकोमा तथा अन्य संचरणीय रोगों का नियंत्रण ।<br>4. खाद्य और दुग्ध व्यवसायों का पर्यवेक्षण । | 1 गर्भिणी माताओं का नेमी या दनिक परीक्षण ।<br>2. शिशु सेवा—जन्म के समय तथा जन्म के बाद ।<br>3. मुआयना—प्रतिरक्षीकरण ।<br>4. अरक्तता (ऐनीमिया) तथा विटामिन की कमी के प्रति निरोधी उपाय ।<br>5. परिवार-नियोजन सम्बन्धी सलाह तथा सेवाएँ । | 1. स्वास्थ्य निरीक्षण, उपचार तथा तत्सम्बन्धी चिकित्सा ।<br>2. प्रतिरक्षीकरण (इम्यूनाइजेशन) ।<br>3. शिक्षक द्वारा निरीक्षण ।<br>4. स्कूल की स्वच्छता ।<br>5. स्कूल में लंच या बीच की छुट्टी का आहार ।<br>6. स्वास्थ्य शिक्षण । |

**रोगाणुनाशन या निर्जर्मीकरण (स्टेरिलाइजेशन)**

संचरणीय रोगों के लिए जिम्मेदार अधिकांश जीवाणु (बैक्टीरिया) और जीव, ताप के प्रति सुग्राही या संवेदनशील होते हैं। इसलिए रोगियों की रोज काम आने वाली चीजों का निर्जर्मीकरण अनिवार्य है। फेनिल, डेटोल सरीखे रोगाणुनाशियों (डिसइन्फेक्टेन्ट) का इस्तेमाल कर रोगाणुओं का नाश किया जाना चाहिए। संक्रमण से बचे रहने के लिए पूतिरोधी (ऐन्टिसेप्टिक) उपाय किए जाने चाहिए। विशेष रूप से संचरणीय रोग से पीड़ित व्यक्ति की देखरेख करने वाले व्यक्ति के सन्दर्भ में।

## अभ्यास

1. सामुदायिक स्वास्थ्य (कम्यूनिटी हैल्थ) की परिभाषा दो।
2. समुदाय विशेष का स्वास्थ्य बनाए रखने के लिए कौन-सी एजेन्सियाँ जिम्मेदार हैं? सामुदायिक स्वास्थ्य कार्यक्रम द्वारा किए जाने वाले विविध क्रियाकलापों का वर्णन करो।

# अध्याय-37

# असंचरणीय रोग

इस प्रकार के रोग केवल उन्हीं व्यक्तियों तक सीमित रहते हैं जो इनसे पीड़ित होते हैं। ये एक आदमी से दूसरे आदमी में नहीं जाते। इन रोगों के नियंत्रण में स्वच्छता व टीके वाले सामान्य जन स्वास्थ्य उपाय इस्तेमाल नहीं किए जाते। लेकिन इन रोगों से बचाव के लिए उचित स्वास्थ्य-शिक्षा व पोषण-शिक्षा देना लाभकारी रहता है। इनमें से कुछ रोग तो तनावों से भरे आधुनिक जीवन की देन हैं।

## हीनताजन्य रोग (डेफीशिएन्सी डिज़ीज)

ये रोग किसी न किसी पोषक तत्व की मात्रा की कमी के कारण उत्पन्न होते हैं। इस समय यहाँ पर हम केवल अपने देश में होने वाले दो महत्वपूर्ण हीनताजन्य रोगों का वर्णन करेंगे यानी क्वाशियोर्कर और विटामिन ए की कमी का रोग।

### क्वाशियोर्कर

यह रोग उग्र रूप से होने वाले प्रोटीन कुपोषण (मालन्यूट्रिशन) से उत्पन्न होता है। हमारे देश में असंख्य बच्चे हैं जो इस रोग से पीड़ित होते हैं। ऐसे बच्चों के लक्षण हैं अवरुद्ध वृद्धि, भूख की कमी, अरक्तता (ऐनीमिया) और बाहर निकला पेट। लगातार दस्त, वजन में कमी और पेशियों की दुर्बलता इसके अन्य लक्षण हैं। साथ ही त्वचा और बालों का रंग उड़ जाता है और त्वचा धब्बेदार हो जाती है तथा टाँगें और पैर सूज जाते हैं।

यह रोग मुख्यतया बच्चों में कम अंतराल रखने, माता द्वारा लम्बे समय तक दूध पिलाने तथा संपूरक भोजन देर से शुरू करने तथा कार्बोहाइड्रेट खाद्य पदार्थों को अधिक अनुपात में खिलाने से होता है।

'यूनीसेफ' (UNICEF), खाद्य एवं कृषि संगठन (एफ० ए० ओ०—FAO) तथा विश्व स्वास्थ्य संगठन (डब्ल्यू० एच० ओ०— WHO) के सहयोग से भारत सरकार ने राष्ट्र व्यापी व्यावहारिक पोषण कार्यक्रम शुरू किया है। इस कार्यक्रम का उद्देश्य है लोगों को पोषण सम्बन्धी आवश्यकताओं की शिक्षा देना, भोजन की उचित आदतों के लिए प्रोत्साहित करना, खाद्य उत्पादन के लिए प्रोत्साहन देना और स्कूल-पूर्व और स्कूली पोषण कार्यक्रमों का संचालन करना।

### विटामिन ए की कमी

विटामिन ए की कमी से होने वाले दो महत्वपूर्ण रोग हैं शुष्काक्षिपाक (ज़ीरोफ्थैलमिया) और रतौंधी।

शुष्काक्षिपाक की विशेषता है आँखों में अश्रु ग्रंथि का अक्रिय होना यानी काम न करना। उग्र अवस्था में इससे सूखापन, जीवाणविक (बैक्टीरियल) वृद्धि और स्वच्छमंडल या कौर्निया का व्रणीभवन (अल्सरेशन) हो जाता है।

यदि इसका उपचार न किया जाय तो इससे अंधापन भी हो सकता है।

रतौंधी की विशेषता यह है कि इसमें कम रोशनी में दिखलाई नहीं पड़ता।

आँख के दृष्टिपटल या रेटीना में विद्यमान दृश्य नील लोहित (*विजुअल पर्पल*) *नामक यौगिक देखने की प्रक्रिया* में महत्वपूर्ण भूमिका अदा करता है। विटामिन ए की कमी से इस दृश्य नील लोहित यौगिक के निर्माण पर असर पड़ता है।

विटामिन ए की कमी से त्वचा का सूखा व पपड़ी जैसा होना तथा देह-गुहा के भीतरी अंगों के उपकला अस्तर (एपिथीलियल लाइनिंग) की क्षति दिखलाई देने लगती हैं। संक्रमण के प्रति प्रतिरोध बनाए रखने में भी यह महत्वपूर्ण भूमिका निभाता है।

विटामिन ए की अधिकता वाले खाद्य पदार्थ से आहार को संपूरित करने पर रोग का उपचार किया जाता है। अधिक विटामिन ए वाले खाद्य पदार्थ हैं—अंडे का पीला अंश, हरी सब्जी, शार्क की कलेजी का तेल (शार्क लिवर ऑयल) तथा मक्खन।

## व्यपजनन रोग (डीजेनरेटिव डिजीज)

इस कोटि में हृदय, केन्द्रीय तंत्रिका तंत्र और अन्य महत्वपूर्ण अंगों के रोग आते हैं।

हमारे शरीर में हृदय बहुत महत्वपूर्ण अंग है। आजकल हृदय के रोग बहुत आम होते जा रहे हैं।

### हृदय-रोगों के कारण

हृदय-रोगों के मुख्य कारणों में धमनीकाठिन्य (आर्टीरियोस्क्लेरोसिस) भी एक कारण है। हृद् धमनी रोग से सम्बन्धित यह एक मूलभूत विकार या गड़बड़ी है। वसा (फैट) यानी चिकनाई वाले पदार्थों के भीतरी जमाव के कारण हृद् धमनियाँ कमजोर पड़ जाती हैं।

इसका परिणाम होता है संरचनात्मक निपात (स्ट्रक्चरल कोलैप्स) और कुछ समय बाद रक्तस्राव (हेमोरेज)।

कभी-कभी रुधिर के प्रवाह पर भी इसका असर पड़ता है और स्कंदन (क्लौटिंग) हो जाता है यानी थक्के बन जाते हैं जिसके परिणामस्वरूप अंततः दिल का तेज दौरा पड़ जाता है। विश्वास किया जाता है कि संतृप्त वसाएँ, जैसे कि मक्खन व क्रीम, हृदय रोग के महत्वपूर्ण कारण हो सकते हैं।

हृदय के विकारों या गड़बड़ियों के अन्य कारण हैं: रूमेटी ज्वर (रयूमेटिक फीवर), उच्च रक्त-दाब, अधिक वजन, हृदय के परिवर्धनात्मक (जन्मजात) दोष, जीवाणु अथवा विषाणु संक्रमण, उग्र प्रकार की अरक्तता, अधिक धूम्रपान, एक स्थान पर स्थिर रहने का स्वभाव और अतिक्रिय अथवा अल्पक्रिय अवटु ग्रंथि (थाइरॉयड ग्लैन्ड)।

### हृद् रोग के लक्षण

सामान्यतया इसके लक्षण इन बातों से सम्बन्धित हैं, जैसे— हृदय द्वारा अपना कार्य न कर पाना, नैजआवर्तितता यानी स्वतः होने वाली लय बद्धता (रिद्म) में बाधा, हृदय की ही पेशियों में रुधिर परिसंचरण की गड़बड़ी। हृद् वाहिकाओं (कोरोनरी वेसल्स) की इस गड़बड़ी से हृदय की पेशियों में ऑक्सीजन और पोषक तत्व यथेष्ट मात्रा में नहीं पहुँचते तो इसका परिणाम दर्द हो सकता है। कभी-कभी हृदय की रुधिर-वाहिकाएँ फट भी सकती हैं और हृदय ऊतकों में रक्तस्राव हो सकता है। ऐसी दशाओं में दर्द इतना तेज हो सकता है कि आघात प्रत्यक्ष कारक हो जाता है जिसका चिकित्सक द्वारा तुरन्त उपचार होना चाहिए। हृदय क्षेत्र में होने वाला छाती का दर्द अनेक कारणों से हो सकता है। हृदय का दर्द बहुत परेशान करने वाला या असहनीय प्रकार का होता है। जब हृदय की पेशियाँ ऑक्सीजन तथा पोषक पदार्थों की कमी के कारण क्षतिग्रस्त हो जाती हैं तो दर्द के साथ तीव्र मतली और कै भी हो सकती है।

कुछ शिशु इस प्रकार पैदा होते हैं कि उनके हृदय में संकुचन (कौन्ट्रैक्शन) के समय मरमर या मरमराहट होती है। अनेक युवा लोगों में किशोरावस्था के दौरान अस्थाई रूप से इस प्रकार की मरमराहट होती है।

### दिल का दौरा या 'हार्ट-अटैक'

सबसे खतरनाक प्रकार का 'हार्ट अटैक' वह है जिसमें हृदय की रुधिर-वाहिकाओं का हृदय के ऊतकों में

रक्तस्राव हो जाता है या जिनमें हृदय की पेशियों की आवश्यकता पूर्ति के लिए रुधिर वाहिकाएँ पर्याप्त रक्त नहीं ले जा पातीं । ऐसा रुधिर-वाहिकाओं के अस्थाई संकीर्णन, हृद् धमनियों में कठोरीकरण तथा व्यपजनन से सम्बद्ध परिवर्तनों या थक्का (क्लौट) बनने के कारण हो सकता है । आयुर्विज्ञान (मेडिसिन) की शब्दावली में हृदय की यह क्षति 'मायोकार्डियल इनफ़ैक्शन' या हृद्पेशी रोधगलन कहलाती है ।

## तम्बाकू और हृदय-रोग

अधिकांश रोगियों में एक या दो सिगरेट पीने के बाद हृदय की गति थोड़ी-सी बढ़ जाती है, और परिधीय (पेरीफेरल) रुधिर-वाहिकाएँ संकुचित होकर कुछ सीमा तक रक्त-दाब बढ़ा देती हैं । तम्बाकू का परिसंचरण-तंत्र (सरकुलेटरी सिस्टम) पर जो असर पड़ता है वह निकोटिन के कारण होता है । लेकिन इस बात में मतभेद है कि निकोटिन हृदय-रोग का कारण है या नहीं ।

हाल के आँकड़ों से पता चलता है कि धूम्रपान और हृद् धमनी रोगों द्वारा बढ़ने वाली मृत्यु दर में निश्चित रूप से गहरा सम्बन्ध है । पर इससे यह साबित नहीं हो जाता कि इस प्रकार के हृदय-रोग से होने वाली अधिक मृत्यु दर का कारण धूम्रपान ही है, लेकिन इस सहसम्बन्ध से यह आभास तो होता ही है कि हृद् रोग वाले व्यक्ति को धूम्रपान छोड़ देना चाहिए ।

## हृदय-शल्यकर्म (हार्ट सर्जरी)

सन् 1926 से हृदय सम्बन्धी शल्यकर्म जान बचाने और जीवन अवधि को बढ़ाने वाली सेवा के रूप में विकसित हो गया है । हृदय के कुछ प्रकार के जन्म-जात दोषों को सुधारने में शल्यकर्म से सफलता प्राप्त हुई है । "ब्लू बेबी" सम्बन्धी हृदय के शल्यकर्म में संरचनात्मक दोषों को इस तरह ठीक किया जाता है कि आक्सीजनित (आक्सीजनेटेड) और अनाक्सीजनित (नौन-आक्सीजनेटेड) प्रकार का रुधिर फिर आपस में मिलने नहीं पाता । हाल के वर्षों में, हृद् धमनी रोगों में, हृदय की पेशियों में प्रतिरोपण (ट्रान्सप्लान्टेशन) करके नए सिरे से रुधिर की आपूर्ति करने के सफल प्रयत्न किए गए हैं । इसे "बेक औपरेशन" (beck operation) कहते हैं और इसे निरापद और प्रभावकारी माना गया है ।

हृदय-रोग से बचाव का सबसे प्रभावकारी उपाय है स्वास्थ्यकर जीवन जीना और हृदय के बारे में बिना बात चिन्ता न करना । कम संतृप्त वसाओं वाले आहार से रुधिर के कोलेस्टरोल स्तर का नियंत्रण हो सकता है जिससे हृद् धमनी रोगों की कमी की संभावना हो सकती है । हमेशा खान-पान की अच्छी आदतें रखने से आयु लम्बी होती है तथा हृदय और परिसंचरणी रोगों के पनपने के मौके कम हो जाते हैं । संक्रामक रोग, अधिक रक्त-दाब अथवा रूमेटी ज्वर से पीड़ित व्यक्ति को डाक्टरी सलाह ले लेनी चाहिए । वजन और मोटापा नहीं होने देना चाहिए । आधारी उपापचय (बेसल मेटाबोलिज़म) की गड़बड़ियों का चिकित्सक द्वारा उपचार करा लेना चाहिए, यदि इनकी पहचान हो जाती है । हृदय-रोगों से बचने के लिए धूम्रपान तथा मद्यपान से भी बचना चाहिए और जरूरत के अनुसार डाक्टर की सलाह से उचित औषधियों का इस्तेमाल होना चाहिए । कार्य के अनुसार अपने को अनुकूलित करना और हृदय के अनुसार आनन्द और मनोविनोद करने से हृदय सबल और स्वास्थ्य अच्छा बना रहता है ।

## आघात या स्ट्रोक

मस्तिष्क को पहुँचने वाली सबसे सामान्य प्रकार की क्षति को आघात या 'स्ट्रोक' कहते हैं । आघात में मस्तिष्क के किसी भाग तक होने वाले खून का संचार या प्रवाह अचानक बन्द हो जाता है । इससे क्या होता है कि उस भाग से सम्बद्ध सभी संरचनाओं को भी क्षति पहुँच जाती है ।

स्ट्रोक इन कारणों से हो सकते हैं—किसी रुधिर वाहिका के फटने पर रक्तस्राव होने से, रुधिर-वाहिका के अन्दर थक्का बनने से, किसी छोटे कण से धमनी की ऐंठन या रुधिर वाहिका के अवरोध से । यह कण प्रायः रुधिर प्रवाह में खून के तैरते थक्के के रूप में हो सकता है ।

आघात (स्ट्रोक) के कारण के आधार पर उपचार भिन्न-भिन्न प्रकार का हो सकता है । आघात से अपंग

बनने वाले रोगी को सामान्यतया पुनः स्वास्थ्य लाभ कराया जा सकता है, यदि वह भयानक नहीं है तो।

## मधुमेह

**मधुमेह** (डाएबिटीज मेलिटस) ऐसा रोग है जिसका लक्षण है रुधिर में शर्करा की अधिक मात्रा की उपस्थिति और पेशाब में उसका उत्सर्जन। इसके विपरीत **उदकमेह** (डाएबिटीज इनसिपिडस), रोग की वह अवस्था है जिसमें पेशाब बहुत अधिक होता है, लेकिन इस अवस्था में मूत्र फीका या स्वादहीन होता है। उदकमेह पीयूष ग्रंथि (पिट्यूटरी ग्लैन्ड) के किसी भाग में गड़बड़ी हो जाने से और मधुमेह लैंगरहैन्स द्वीप (आइलेट्स लैंगर-हैन्स) नामक अंतःस्रावी (एन्डोक्राइन) ग्रंथि की दोषपूर्ण क्रिया से सम्बद्ध है। यह लैंगरहैन्स द्वीप नामक ग्रंथि इन्सुलिन नामक हारमोन का स्रवण करती है।

मधुमेह का रोगी पानी बहुत अधिक मात्रा में पीता है क्योंकि वह प्रायः प्यास महसूस करता रहता है। इसके अन्य लक्षण हैं—बहुत अधिक पेशाब आना, बार-बार पेशाब आना, अधिक भूख लगना, वज़न में कमी तथा सामान्य कमजोरी। यह रोग तरुण व वृद्ध स्त्रियों व पुरुषों को प्रभावित करता है। मधुमेह का सर्वप्रथम स्पष्ट लक्षण है मूत्र में शर्करा की उपस्थिति और रुधिर-शर्करा का उच्च स्तर।

इन्सुलिन को उपचार के रूप में नहीं बल्कि उपचार के बदले इस्तेमाल किए जाने वाले विकल्प के रूप में प्रयुक्त किया जाता है। इन्सुलिन अच्छी मानकीकृत (स्टैन्डर्डाइज्ड) मात्राओं में उपलब्ध होता है। टोलव्यूटा-माइड सरीखी औषधियों को मुँह द्वारा लिया जा सकता है। लेकिन ये औषधियाँ इन्सुलिन का स्थान नहीं ले सकतीं।

यदि मधुमेह का रोगी लम्बी व आरामदायक जिन्दगी चाहता है तो खुद की देखभाल करने की दो विधियाँ हैं—इन्सुलिन की व्यवस्था और मूत्र का विश्लेषण। मधुमेह रोगी का स्वास्थ्य और अमन चैन ली गई इन्सुलिन की मात्रा, आहार और की गई कसरत पर निर्भर करता है।

## संधिशोथ या आर्थ्राइटिस

इसे सही मायने में व्यपजनन-रोग नहीं कहा जा सकता। एक प्रकार का संधिशोथ (आर्थ्राइटिस), जिसे व्यपजनन संधिशोथ कहते हैं, चढ़ती उम्र का रोग है। संधिशोथ एक सामान्य शब्द है जिसे कई किस्म के रोगों के लिए प्रयुक्त किया जाता है और जिनकी विशेषता है जोड़ों या संधियों की अपसामान्यता। इनमें से सबसे सामान्य है व्यपजनन संधिशोथ और रूमेटी संधिशोथ।

व्यपजनन-संधिशोथ आमतौर पर 40 साल की उम्र के बाद होता है। हड्डियों में कालप्रभावन (एजिंग) की प्रक्रिया जल्दी शुरू हो जाती है। व्यपजनन की प्रक्रिया पहले उपास्थि (कार्टिलेज) को प्रभावित करती है। यह उपास्थि जोड़ों के धक्कों या आघातों को सोखती या सहती है, और इसकी हानि से रोग सम्बन्धी परिवर्तन शुरू होने लगते हैं।

रूमेटी संधिशोथ पहले उस झिल्ली पर आक्रमण करता है जो जोड़ों के बीच में होती है (सिनोविअल मेम्ब्रेन) और इस आक्रमण की वजह से शोथ (इनफ्लैमेशन) हो जाता है। अंततः इससे जोड़ में कड़ापन (अस्थिसमेकन—अंकाइलोसिस) आ जाता है।

संधिशोथ या आर्थ्राइटिस के रोगियों को भौतिक चिकित्सा (फिजियोथिरेपी) से चैन मिलता है। इस प्रकार आमतौर पर संधिशोथ का रोगी वह है जिसके जोड़ पुराने पड़ गए हों। लेकिन उचित देखभाल और सावधानी से वृद्ध होने के साथ-साथ आरामपूर्वक भी रहा जा सकता है।

## कैन्सर

कैन्सर कोशिकाओं का रोग है। इसकी शुरुआत अधिकांशतया उन्हीं ऊतकों में होती है जो स्वभावतः अपना नवीनीकरण करते रहते हैं, जैसे कि त्वचा, पाचन-पथ के अस्तर या लाईनिंग, जनन तंत्र के अंग, फेफड़े और यकृत। सामान्यतया नियंत्रित प्रकार से जनन करने वाली कोशिकाएँ अचानक इन ऊतकों में अंधाधुन्ध रूप से विभाजित होने लगती हैं और वृद्धि करते जाने वाले बड़े अर्बुद (ट्यूमर) बनाने लगती हैं, जिसका कारण अब तक अज्ञात है। इन अर्बुदों की पृथक कोशिकाएँ

रुधिर प्रवाह या लसीका-तंत्र में पहुँच जाती हैं और फिर शरीर के अन्य भागों को भी ले जाई जाती हैं। यहाँ भी वे जनन करते हुए वृद्धि करती जाती है जिससे अन्य ऊतकों की सामान्य शारीरिक प्रक्रिया में बाधा पहुँचती है। यदि विकिरण (रेडिएशन), रसायन चिकित्सा अथवा शल्य चिकित्सा से इनका उपचार न किया गया तो प्राय: ये दुर्दम (मेलाइनेन्ट) कोशिकाएँ तब तक बढ़ती जाती हैं जब तक कि शारीरिक प्रक्रियाओं में बाधा पहुँचाते हुए अंततः ये मृत्यु का कारण नहीं बन जातीं।

जहाँ तक कैन्सर की संभावना का सम्बन्ध है खतरे के सात संकेत हैं जिनके आधार पर व्यक्ति को तुरन्त डाक्टर की सलाह ले लेनी चाहिए। ये संकेत निम्नलिखित हैं :

1. कोई ठीक न होने वाला घाव।

2. छाती में या अन्यत्र गाँठ या ढेले जैसी अपवृद्धि।

3. असामान्य प्रकार से रक्तस्रवण (ब्लीडिंग) अथवा विसर्जन (डिस्चार्ज)।

4. मस्से या तिल में परिवर्तन होना।

5. निरन्तर अपाचन बने रहना या निगलने में कठिनाई होना।

6. स्थायी रूप से स्वररुक्षता (होर्सनेस) अथवा खाँसी।

7. आँत्र-प्रकृति में परिवर्तन होना यानी शौच जाने की आदत में परिवर्तन होना।

कैन्सर का निदान निम्नलिखित एक या अनेक क्रिया-विधियों से किया जाता है—(1) जीवित परीक्षा (बायोप्सी), (2) एक्स-रे, (3) शरीर के तरल पदार्थों का सूक्ष्मदर्शी में परीक्षण तथा (4) रुधिर की परीक्षा।

चिकित्सा विज्ञान के अनुभव से स्पष्ट है कि कैन्सर के अधिकांश रोगियों को ठीक किया जा सकता है, यदि इस विकार या गड़बड़ी का निदान आरम्भिक अवस्था में हो जाता है। देर से निदान होने पर कैन्सर का खतरा अधिक बढ़ जाता है।

आमाशय का कैन्सर बहुत महत्व का है। इसका कारण ज्ञात नहीं है। आमाशय के कैन्सर की पहचान का सबसे प्रभावकारी साधन है—एक्स-रे या प्रतिदीप्ति (फ्लुओरेसेन्स) का प्रयोग। इसके निदान के लिए प्राय: गैस्ट्रोस्कोप नामक यंत्र का प्रयोग किया जाता है, जो आमाशय के भीतरी भाग का निरीक्षण करने की एक महत्वपूर्ण युक्ति है। यदि आरम्भ में पहचान हो जाय तो आमाशय के कैन्सर को ठीक किया जा सकता है।

### फेफड़े का कैन्सर

पिछले करीब पच्चीस वर्षों के दौरान शव परीक्षा (ओटोप्सी) सम्बन्धी पूरे विश्व की जानकारी से पता चला है कि फेफड़े के कैन्सर से होने वाली मृत्यु में वृद्धि हुई है। इस रोग में कोई आरम्भिक लक्षण नहीं होते कि सामान्य श्वसन-रोगों से उनका अंतर स्पष्ट किया जा सके। रोग में कोई भी शारीरिक लक्षण नहीं दिखलाई देते।

आरम्भिक अवस्था में फेफड़े के कैन्सर की सबसे अच्छी पहचान की विधि है समय-समय पर छाती का एक्स-रे परीक्षण। थूक का सूक्ष्मदर्शीय निरीक्षण करने पर और फिर एक्स-रे परीक्षण द्वारा इसकी पुष्टि की जा सकती है। संदेहास्पद रोगियों में छाती का शल्यचिकित्सीय अन्वेषण भी किया जाता है।

वायु प्रदूषण को फेफड़े के कैन्सर का एक कारण माना जाता है। हाल के वर्षों में धूम्रपान को भी फेफड़े के कैन्सर का एक संदिग्ध कारण माना गया है। इस बारे में अभी ज्ञात नहीं है कि तम्बाकू के धुएँ का कौन-सा विशेष घटक कैन्सर का असली कारण है। लेकिन तम्बाकू के ऐसे घटकों में से एक घटक तो ऐसा खोज ही लिया गया है जिससे कैन्सर होना साबित किया गया है, और यह घटक है बेंजपाइरीन। अन्य दो पदार्थ जिन्हें कैन्सर करने वाला कहा जाता है, वे हैं आर्सनिक और टार।

### अधिश्वेतरक्तता (ल्यूकीमिया)

ल्यूकीमिया रक्त बनाने वाले अंगों की दुर्दमता या मैलाइनेन्सी (कैन्सर) है। यह ऐसा कैन्सर है जिसमें श्वेत रुधिर कोशिकाओं की अपसामान्य रूप से बढ़ोतरी हो जाती है और जो फिर अन्य ऊतकों में भी घुस पहुँचती हैं, जैसे कि अस्थि-मज्जा (बोन मैरो), प्लीहा या तिल्ली (स्प्लीन) और लसीका पर्वों (लिम्फ नोड्स) में। उग्र प्रकार का ल्यूकीमिया अधिकांशतया पाँच साल से नीचे के बच्चों में

होता है और इस वय वर्ग में यह मृत्यु का एक प्रमुख कारण है। लेकिन यह किसी भी उम्र में हो सकता है। हर प्रकार का ल्यूकीमिया घातक होता है। अभी तक इसको ठीक करने की कोई वास्तविक उपचार विधि ज्ञात नहीं हो सकी है।

### क्या कैन्सर आनुवंशिक या पैतृक रोग है?

यह सिद्ध नहीं हो सका है कि मानव में कैन्सर आनुवंशिक है। लकिन साथ ही यह भी अच्छी तरह साबित नहीं हुआ है कि यह आनुवंशिक नहीं है। सही निष्कर्ष निकालने के लिए अभी पर्याप्त प्रमाण नहीं मिल सके हैं।

## एलर्जी

एलर्जी उस किसी भी अवस्था को कहा जा सकता है, जिसमें कोई व्यक्ति किसी पदार्थ या कारक (एजेन्ट) के प्रति अतिसंवेदनशील अथवा असामान्य प्रकार की अनुक्रिया दिखलाता है। लोगों को कई चीजों से एलर्जी हो सकती है, जैसे भोजन पदार्थों, औषधियों, धूल, पराग, कपड़ों, पौधों, बैक्टीरिया, प्राणियों, ताप, सूर्य के प्रकाश अथवा अन्य कई पदार्थों से। एलर्जी के परिणामस्वरूप होने वाले लक्षण कई प्रकार के हो सकते हैं, लेकिन अधिकांशतया यह त्वचा और श्लेष्मा झिल्ली (म्यूकस मेम्ब्रेन) को ही प्रभावित करते हैं। त्वचा की ऐसी अतिसंवेदनशील अवस्था सारे शरीर में होने वाले परिवर्तनों के कारण ही होती है।

एलर्जी की अभिक्रिया होने के लिए दो बातें जरूरी हैं। पहले किसी विशिष्ट पदार्थ के प्रति आरम्भिक संवेदनीकरण (सेन्सिटाइजेशन) होना चाहिए। व्यक्ति को इस प्रथम उद्भासन या सम्पर्क (एक्सपोजर) का पता कभी भी नहीं चलता और इसी कारण प्रायः जो व्यक्ति एलर्जी की प्रक्रिया में होता है उसे यह विश्वास नहीं होता कि वह पहले संवेदीकृत (सेन्सिटाइज्ड) हो चुका है। लेकिन फिर किसी पदार्थ से दुबारा सम्पर्क होना भी जरूरी है और इसी समय एलर्जी के प्रारूपी या सामान्य लक्षण दिखलाई देने लगते हैं। सामान्यतया पदार्थ के निराकरण से एलर्जी के लक्षण बड़ी जल्दी गायब हो जाते हैं जिसके प्रति कि व्यक्ति अतिसंवेदनशील होता है। किन्तु फिर से उसका सम्पर्क होने पर ये लक्षण पुनः प्रकट हो जाते हैं। 'हे फीवर' नाक, आँख, और ऊपरी श्वसन-पथ की श्लेष्मा-झिल्लियों को प्रभावित करता है। दमा (ऐस्थ्मा) में श्वसन-पथ का निचला भाग बुरी तरह से प्रभावित हो जाता है।

एलर्जी से सम्बद्ध त्वचा का सबसे अधिक सामान्य परिवर्तन है लाल हो जाना। अधिचर्म (एपिडर्मिस) के नीचे प्रायः ऊतक के तरल पदार्थों का जमाव हो जाता है। एलर्जी से सम्बन्धित दूसरा लक्षण है छाजन या एक्ज़िमा। एक्ज़िमा में त्वचा लाल हो जाती है और फिर इसके बाद इसमें छोटे-छोटे छाले पड़ जाते हैं। एक्ज़िमा शरीर के कई क्षेत्रों में हो सकते हैं, और एलर्जी के अन्य लक्षणों में यह सबसे उग्र लक्षण है। समय समय पर जो अन्य लक्षण दिखलाई देते हैं वे हैं—ग्रंथिकाएँ या गाँठें और बड़े-बड़े छाले।

एलर्जी विशिष्ट खाद्य पदार्थों, औषधियों, कपड़ों, धूल, पराग, पौधों, प्राणियों, गरमी, ठंड और प्रकाश से होती है। कभी-कभी एलर्जी के ऐसे लक्षण भी प्रकट होते हैं जिनको इन कारकों में से किसी से भी नहीं जोड़ा जा सकता। यह माना जाता है कि ऐसे लक्षण शरीर पर मानसिक प्रभाव से उत्पन्न होते हैं। ये कैसे उत्पन्न होते है इससे सम्बन्धित प्रक्रिया अभी भली भाँति ज्ञात नहीं है।

व्यक्ति का उचित उपचार करने के पहले यह निश्चित कर लिया जाना चाहिए कि वह किस पदार्थ के प्रति अतिसंवेदनशील है। कई प्रकार के एलर्जी-विकारों के उपचार में एन्टिहिस्टामाइन वर्ग की औषधियाँ काफी महत्वपूर्ण हैं।

## अभ्यास

1. हीनताजन्य (डेफीशिएन्सी) रोग से क्या समझते हो ? हीनताजन्य रोगों से लड़ने के लिए कौन से कारक सम्बद्ध हैं ?
2. क्वाशियोर्कर के क्या चिह्न और लक्षण हैं ?
3. व्यपजनन-रोग से क्या समझते हो ? इनकी रोकथाम सामुदायिक स्वास्थ्य कार्यकर्त्ता की अपेक्षा व्यक्ति से क्यों सम्बद्ध है ?
4. हृदय-रोगों के मुख्य कारण क्या हैं ? धूम्रपान हृदय और फेफड़ों के रोगों को किस प्रकार प्रभावित करता है ?
5. "कैन्सर को ठीक नहीं किया जा सकता और यह आनुवंशिक है"—इस कथन पर टीका-टिप्पणी करो ।

# अध्याय-38

# मदिरोन्मत्तता और दवाओं का व्यसन

धूम्रपान, मदिरापान और दवाओं का व्यसन सामाजिक रोग हैं जो लोगों का स्वास्थ्य चौपट कर देते हैं, जनशक्ति की हानि करते हैं और आर्थिक प्रगति में बाधा पहुँचाते हैं। लोगों में इनकी कुटेव किशोरावस्था में हँसी मजाक के लिए या उत्सुकता की संतुष्टि के लिए या थोथे तर्कों के कारण पड़ती है। लेकिन ऐसी आदत पड़ने पर शीघ्र ही ये उस सीमा पर पहुँच जाते हैं जहाँ से लौटना मुश्किल होता है और वे इसके परिणाम भुगतने के लिए मजबूर हो जाते है। पिछले अध्याय में हम धूम्रपान के दुष्प्रभावों का वर्णन कर ही चुके हैं। इस अध्याय में हम दो अन्य बुराइयों, मदिरा सेवन और दवा के व्यसन का वर्णन करेंगे।

## मदिरोन्मत्तता या मदिरा सेवन

मदिरा का सेवन समाज के गरीब और समृद्ध दोनों प्रकार के लोगों द्वारा किया जाता है। पेय किसी भी प्रकार का हो, यदि उसमें एल्कोहॉल है तो उससे नशा या उन्माद होता है। इसका असर भी वैसे ही होता है जैसे और विषों का होता है।

पहले ही घूंट से नशा होने लगता है लेकिन आरम्भिक लक्षण दिखलाई नहीं देते। इसकी मात्रा बढ़ती जाती है तो शरीर पर का नियंत्रण ढीला पड़ जाता है। धीरे-धीरे व्यक्ति अपनी चेतना खो बैठता है और इसकी चरम अवस्था में तो मृत्यु भी हो सकती है।

जो लोग मदिरा पीने की आदत डालते हैं वे इसके हानिकारक परिणामों को जाने बिना या उनके बारे में सोचे बिना ही ऐसा करते हैं। वे इसकी शुरुआत थोड़ी-सी मात्रा से ही करते हैं लेकिन शीघ्र ही नौसिखिए इसके आदी हो जाते है और वो एल्कोहॉल की काफी अधिक मात्रा लेने लग जाते हैं। जब वे एल्कोहॉल या शराब के दुष्प्रभाव के शिकार हो जाते हैं तो तब बहुत अधिक देर हो चुकती है और उनका इसे छोड़ना कठिन हो जाता है।

## एल्कोहॉल के प्रभाव

अनुसंधान के परिणामों से पता चला है कि जो लोग मदिरा पान करते हैं वे निम्नलिखित कारणों में से एक या अनेक कारण बतलाते हैं—(1) सामाजिक दबाव (2) उन्मुक्तता की अनुभूति (3) स्वाद की चाह (4) उत्तेजना की इच्छा (5) असन्तुष्टि तथा असफलताओं सरीखी जीवन की वास्तविकताओं से पलायन की इच्छा (6) दैनिक जीवन की परेशानियाँ व एकरसता।

इससे जो भी प्रत्याशाएँ हों लेकिन यह सिद्ध कर लिया जा चुका है कि मदिरा के सेवन से व्यक्ति के स्वास्थ्य व पारिवारिक जीवन पर प्रभाव पड़ता है और अन्ततः इससे सामुदायिक समस्याएँ उठ खड़ी होती हैं। प्रत्याशित फायदों की अपेक्षा इससे होने वाले हानिकारक प्रभाव कहीं अधिक गम्भीर होते हैं। अतः इनका पृथक रूप से विवेचन करना उचित होगा।

### (क) स्वास्थ्य पर प्रभाव

कई लोग मदिरा का सेवन एक प्रकार के "उद्दीपन" या उत्तेजन के लिए करते हैं लेकिन वास्तव में यह तंत्रिका तंत्र (नर्वस सिस्टम) का अवसादन करता है और इस तरह शामक (सेडेटिव), वेदनाहर (एनलजेसिक) और संवदेनाहर (एनेस्थेटिक) का कार्य करता है। यह शरीर के हर प्रकार के ऊतक (टिश्यू) की दक्षता को कम कर देता है। चिरकारी (क्रोनिक) मद्यप में तंत्रिका की तंत्रिकाओं (ऐक्सोन) में शोथ या सूजन हो जाती है जिससे तंत्रिकाशोथ (न्यूराइटिस) नामक रोग हो जाता है। तंत्रिका-तंत्र पर एल्कोहॉल के लम्बे समय वाले प्रभाव से विभिन्न मानसिक व शारीरिक लक्षण उत्पन्न हो जाते हैं।

एल्कोहॉल से शरीर में अधिक ऊर्जा और गर्मी उत्पन्न होती है। लेकिन साथ ही इससे रुधिर-वाहिकाओं का विस्फारण (डाइलेशन) भी हो जाता है। इस प्रकार उत्पन्न गर्मी (ताप) जल्दी नष्ट हो जाती है। निरन्तर विस्फारण से धमनियों की दीवारें बड़ी जल्दी भंगुर और कड़ी हो जाती हैं। रुधिर-वाहिकाओं के लक्षण में इस प्रकार का परिवर्तन होता है और एल्कोहॉलीय वसा के जमा होने से हृदय की क्रियाविधि पर भी प्रभाव पड़ता है।

एल्कोहॉल की थोड़ी मात्रा और अल्प सान्द्रता से जठरीय रसों का स्रवण उद्दीपित होता है। लेकिन अधिक मात्रा और अधिक सान्द्रता से विपरीत प्रभाव पड़ता है। एल्कोहॉल से आमाशय के अस्तर पर सूजन या शोथ हो जाती है। अधिकांश मदिरा पीने वाले, विशेषकर वे, जो खाली पेट पीते हैं, जठरशोथ (गैस्ट्राइटिस) के शिकार हो जाते हैं।

एल्कोहॉल या मदिरा से जिस महत्वपूर्ण अंग को क्षति पहुँचती वह है यकृत् (लिवर)। यकृत् ग्लाइकोजन का भंडार घर होता है लेकिन एल्कोहॉल से यकृत् में वसा जमा होने लग जाती है। धीरे-धीरे यकृत् कड़ा होने लगता है और साथ ही सूखने भी लगता है। एक बार यकृत् के क्षतिग्रस्त होने पर उसका असर शरीर के अन्य अंगों पर भी पड़ता चला जाता है।

एल्कोहॉल या मदिरा पीने वाले अपने स्वास्थ्य की उपेक्षा करने लगते हैं और इससे रोगों के संक्रमण के प्रति शरीर की रोध क्षमता कम हो जाती है। मद्यप अधिकांशतया कुपोषण के शिकार हो जाते हैं और न्युमोनिया सरीखे रोगों के प्रति संवेदनशील बन जाते हैं।

### (ख) परिवार और समुदाय पर प्रभाव

मदिरा पान से पीने वाले की समस्याएँ ही नहीं पैदा होतीं बल्कि प्रत्यक्ष और अप्रत्यक्ष रूप से परिवार और समुदाय के जीवन पर भी इनसे प्रभाव पड़ता है।

एल्कोहॉलीय पेय बहुत मंहगे होते हैं और अपने स्वार्थपूर्ण स्वभाव के कारण अधिकांश मदिरा सेवी अपने बच्चों और परिवार के लोगों को उनकी मूलभूत आवश्यकताओं से वंचित रखते हैं। इससे वे स्वास्थ्य सम्बन्धी व अन्य प्रकार की समस्याएँ उत्पन्न कर देते हैं। शराब का पीना अन्य सामाजिक अपराधों से भी सम्बद्ध है और इसकी री में नैतिक व सांस्कृतिक प्रतिबंध भी धुल जाते हैं।

समुदाय या समाज में हिंसा और अन्य प्रकार की वारदातें भी प्रायः प्रत्यक्ष और परोक्ष रूप में शराब पीने के कारण होती हे। शराब के सेवन से उद्योगों में दुर्घटनाओं की दर बढ़ जाती है और उत्पादन की दर कम हो जाती है। सड़कों पर की दुर्घटनाएँ भी प्रायः पियक्कड़ ड्राइवरों के कारण ही होती हैं। गैरकानूनी रूप से शराब बनाने और बेचने सरीखे क्रियाकलापों से समाज विरोधी गतिविधियों को बढ़ावा मिलता है।

## दवाओं का व्यसन

दवाओं का प्रयोग सामान्यतया रोगों के उपचार में किया जाता है। ये वे रसायन हैं जो केन्द्रीय तंत्रिका तंत्र के प्रति प्रतिक्रिया दिखलाते हैं और व्यक्ति पर मानसिक व शारीरिक रूप से प्रभाव डालते हैं। लम्बे समय तक दवाओं के प्रयोग से शरीर उन पर ही निर्भर रहने का आदी हो जाता है, और इसी को दवा का व्यसन कहते हैं। कुछ लोग बिना डाक्टरी सलाह के दवाएँ लेना शुरू कर देते हैं और वे शीघ्र ही दवा के व्यसनी बन जाते है। कुछ दवाओं के प्रयोग से उनको लगातार लेने की आदत ही बन जाती है और शरीर पूरी तरह

से उन पर ही निर्भर रहने लगता है। व्यसनी बनाने वाली दवाओं से छुटकारा पाना संभव है लेकिन छोड़ने पर होने वाले गम्भीर प्रभावों के कारण उन दवाओं का त्याग करना बहुत मुश्किल हो जाता है जिन पर शरीर पूरी तरह से निर्भर रहने लगता है। दवाओं को दो समूहों में वर्गीकृत किया जा सकता है :

**(क) स्वापक (नार्कोटिक)**—जो तंत्रिका तंत्र की क्रियाशीलता को संदमित या कम कर देती है; जैसे अफीम व उसके व्युत्पन्न (डेरिवेटिव), संश्लेषी किस्म के पदार्थ।

**(ख) उद्दीपक (स्टिमुलेन्ट्स)**—जो केन्द्रीय तंत्रिका तंत्र के क्रियाकलापों को बढ़ा देते हैं; या तो प्रत्यक्ष रूप से कोशिकाओं की सक्रियता को बढ़ाकर या कुछ तंत्रिकाओं की सामान्य संदमनी (इनहिबिटरी) क्रिया का अवरोध करके, जैसे एम्फेटेमीन समूह।

## दवा का व्यसन कैसे शुरू होता है?

इस लत के पड़ने के कई कारण हैं :

**(1) उत्सुकता**—अखबार, साहित्य और रेडियो में बार-बार दवाओं के बारे में जो जानकारी दी जाती है, उत्सुकता वश व्यक्ति खुद ही उसका सच्चा अनुभव करना चाहता है। कुछ को यह अच्छा लगता है और इस तरह धीरे-धीरे लत पड़ जाती है।

**(2) अभिजात वर्ग का जोर**—मित्रों द्वारा लगातार "अच्छी अनुभूति" की चर्चा करते रहने से भी लोभ आ जाता है। दोस्तों और अभिजात वर्ग द्वारा बल दिए जाने पर भी दवाओं का व्यसन शुरू हो जाता है।

**(3) निराशाओं और चिन्ताओं से छुटकारा पाने के लिए**—व्यक्तिगत समस्याओं से मुक्ति पाने की इच्छा से भी दवाओं की लत पड़ती है। जो स्कूली बच्चे दवाओं की शरण में जाते हैं, वे ऐसा प्रायः अकेले-पन, प्यार से वंचित रहने व असुरक्षा की भावना के कारण करते हैं।

**(4) उत्तेजना और अपूर्व अनुभव के लिए**—तरुण लोगों का उत्तेजना के कार्य के लिए तैयार होना स्वाभाविक ही है। चूंकि इस प्रकार से दवाओं का लेना गैरकानूनी है इसलिए इससे उनकी उत्तेजना और जोखिम या नए अनुभव की भावना की संतुष्टि होती है।

**(5) एक नई दुनिया देखने की ललक**—कुछ यह विश्वास करते हैं कि नशीली दवाओं से एक नई दुनिया का बोध होता है और सौन्दर्य भावना, बौद्धिक आनन्द एवं सृजनशीलता की भावना में वृद्धि होती है।

**(6) अधिक शारीरिक व मानसिक कार्य करने की इच्छा**—कुछ लोग काम करने की क्षमता बढ़ाने के लिए दवाओं का प्रयोग करते हैं। कुछ विद्यार्थी इम्तहान से पहले रात भर पढ़ने के लिए दवाओं का इस्तेमाल करते हैं। लेकिन इस तरह से तो मानसिक गड़बड़ी ही अधिक होती है।

**(7) दर्द से छुटकारा पाने के लिए निरंतर प्रयोग**—दर्द से पीड़ित व्यक्ति उससे छुटकारा पाने के लिए दवाओं का इस्तेमाल करते हैं। कभी-कभी यह निरंतर प्रयोग डाक्टर के नुस्खे के कारण भी होता है। लेकिन इस तरह वे व्यसनी बन जाते हैं और इनके बिना तो वे जिन्दा ही नहीं रह सकते।

**(8) पारिवारिक इतिहास**—परिवार में जब माता-पिता या अन्य सदस्यों को दवा इस्तेमाल करते देखा जाता है तो इससे भी दवाओं की लत शुरू हो जाती है।

इस तरह इनकी शुरुआत का जो भी कारण हो, अधिकांश दवा-व्यसनियों में असुरक्षा की भावना रहती है और वे मनोवैज्ञानिक रूप से असंतुलित होते हैं। उन्हें जीवन बड़ा नीरस व असहनीय सा लगता है, और निराशा तथा दुःख से भरा हुआ प्रतीत होता है। सारी दुनिया में ही नशीली दवाओं का यह व्यसन बढ़ता चला जा रहा है और युवा लोगों में तो कुछ अधिक ही है। नौसिखिये की पहचान करना बड़ा कठिन होता है। शराब या तम्बाकू के इस्तेमाल करने वाले की कुछ पहचान की जा सकती है लेकिन दवा लेने वाले की इस प्रकार की पहचान नहीं हो सकती। फिर भी दवा के व्यसनी आरम्भिक अवस्था में बड़े विनीत, शांतिप्रिय और चुप्पे होते हैं। वे यह जानते हैं कि वे गैरकानूनी काम कर रहे हैं इसलिए वे इसका जरा भी मौका नहीं देना चाहते कि पहचाने जाएँ। जब उनकी पहचान होती

है तो इसके पहले ही वे दवा के व्यसनी हो चुकते हैं और फिर उनको सुधारना या उनका पुनः स्थापन करना बहुत मुश्किल हो जाता है।

## दवाओं के बुरे प्रभाव क्या हैं ?

दवाओं को लने का जो भी कारण हो या आरम्भिक परिणाम जो भी हो ऐसी सभी दवाएँ (स्वापक और उद्दीपक दोनों) शरीर के लिए हानिकारक होती हैं। कुछ दवाओं के दुष्प्रभाव नीचे दिए जाते हैं :

**(i) अफीम और उसके व्युत्पन्न (डेरीवेटिव)**— अफीम पोस्त के पौधे के कच्चे संपुटों या डोंडों का सारसत्त होती है। खाकर या धूम्रपान के रूप में इसे इस्तेमाल किया जाता है। अफीम से व्युत्पन्न यौगिकों का—जैसे मोर्फीन, हेरोइन व कोडीन का भी इस्तेमाल किया जाता है। पेथिडीन तथा मेथीडोन सरीखी कुछ संश्लेषी दवाएँ भी अफीम से व्युत्पन्न पदार्थों के जैसे प्रभाव उत्पन्न करती हैं।

अफीम से व्युत्पन्न पदार्थ श्वसन और हृद्वाहिका कार्डियोवैस्कुर की क्रियाशीलता को एकदम कम कर देते हैं, आँख की पुतली (प्यूपिल) को संकुचित कर देते हैं, दृष्टि की क्रियाशीलता को कम कर देते हैं और मतली व कै करवाने में भी योग देते है। अधिक मात्रा में तो श्वसन तक रुक जाता है और मृत्यु हो जाती है। यदि दवा उपलब्ध नहीं होती तो व्यसनी बड़े भयानक "अपनयन लक्षणों" (विदड्राअल सिम्पटम्स) का प्रदर्शन करता है और इन्हें पेशी की ऐंठन, बहती नाक, कै और मिरगी या अपस्मार (एपिलेप्सी) के रूप में बखूबी देखा जा सकता है।

**(ii) भाँग के पौधे के उत्पाद**– भाँग के पौधे (**कैनाबिस इन्डिका**) की सूखी पत्तियों और फूलों से भाँग, गाँजा और चरस नामक तीन दवाएँ प्राप्त की जाती हैं। दूसरी दवा मेरीजुआना एक दूसरे प्रकार के भाँग के पौधे (**कैनाबिस सेटाइवा**) से प्राप्त की जाती है। इनको लेने के तुरन्त बाद आँखों की पुतलियाँ फैल जाती हैं, रुधिर-शर्करा का स्तर बढ़ जाता है और पेशाब बार-बार आता है। अन्य दवाओं की तुलना में ये दवाएँ कम हानिकारक लग सकती हैं लेकिन इनका परिणाम 'हेरोइन' व्यसन भी हो सकता है। इनमें कुछ दवाओं (जैसे मेरीजुआना) से चिंता जनक स्थिति भी उत्पन्न हो सकती है क्योंकि इससे मनोविक्षिप्ति (साइकोसिस) भी हो सकती है।

**(iii) कोका पौधे के उत्पाद**—इसके व्युत्पन्न को कोकेन कहते हैं। इसके दुष्प्रभाव हैं नींद न आना, भूख कम लगना तथा विभ्रम (हेलुसिनेशन) होना और अन्ततः जिसका परिणाम होता है विक्षिप्त प्रकार के मानसिक क्रिया-कलाप तथा पागलपन। इसके गलत इस्तेमाल से तेज सिर दर्द व आक्षेप (कनवल्सन) हो सकता है और फिर हृद्वाहिका या श्वसन-पात (फेल्यौर) से मृत्यु भी हो सकती है।

## एल०एस०डी०

यह एक जर्मन शब्द का संक्षिप्त रूप है जो पूरा इस प्रकार है—डी– लाइसर्जिक एसिड डाइमेथिलएमाइड 15। यह अर्गट कवक से व्युत्पन्न होता है। इस दवा से चिरकारी मनोविक्षिप्ति हो जाती है तथा केन्द्रीय तंत्रिका-तंत्र को भारी क्षति पहुँचती है। यह गुणसूत्रों (क्रोमोसोम) को भी क्षति पहुँचाता है, और इसके कारण अपसामान्य गर्भ उत्पन्न होता है।

## एम्फेटेमीन प्रकार के तथा अन्य प्रकार के उद्दीपक

ये संश्लेषी दवाएँ (सिन्थेटिक ड्रग) अधिक क्रियाशीलता और स्फूर्ति के लिए ली जाती हैं। अधिक मात्रा में लेने पर नींद न आने की दशा आ जाती है।

## बार्बिट्यूरेट

ये संश्लेषी दवाएँ व्यापक रूप से शामक (सेडेटिव) के रूप में इस्तेमाल की जाती हैं। इनसे केन्द्रीय तंत्रिका तंत्र की क्रियाशीलता मंद पड़ जाती है, चिंता कम हो जाती है और नींद आ जाती है। बार्बिट्यूरेट की सामान्य मात्रा के बाद एल्कोहॉल लेने से मृत्यु हो सकती है। एक बार इनका व्यसन पड़ जाने पर फिर इस लत का छुड़ाना मुश्किल हो जाता है। इसको छुड़वाने पर मिरगी के से लक्षण प्रकट होने लगते हैं।

इस प्रकार यह स्पष्ट है कि सभी दवाएँ केन्द्रीय तंत्रिका-तंत्र पर असर करती हैं और लम्बे समय तक

इनके इस्तेमाल से स्थायी क्षति हो जाती है। इनसे ऐसी आदत पड़ जाती है कि दवा के बिना शरीर काम ही नहीं करता। अंत में अन्य अंग भी क्षतिग्रस्त हो जाते हैं और चूंकि दवा का इस्तेमाल करने वाले ठीक से खाते पीते नहीं और स्वास्थ्य के नेमी उपायों का पालन नहीं करते इसलिये वे कई प्रकार के रोगों के शिकार हो जाते हैं। व्यक्ति सचमुच अपंग की जिन्दगी बिताता है और यदि दवा का इस्तेमाल कम उम्र से शुरू होता है तो अकाल मृत्यु हो जाती है।

दवा का इस्तेमाल करने वाले खुद तो इनके बुरे प्रभावों के शिकार होते ही हैं साथ ही अपने परिवार की भी दुर्दशा कराते हैं। व्यसनी लोग दवाओं को अवैध स्रोतों और गलत तरीकों से प्राप्त करते हैं जिससे तस्करी और अन्य गैरकानूनी क्रिया-कलापों को बढ़ावा मिलता है। इस प्रकार यह एक सामाजिक समस्या भी है जिससे समुदाय को जूझना और भुगतना पड़ता है।

## अभ्यास

1. एल्कोहॉलीय पेयों को जहर क्यों समझा जाता है?
2. लोग मदिरा क्यों पीते हैं? ये कारण कहाँ तक ठीक हैं?
3. एल्कोहॉलीय पेयों के हानिकारक प्रभाव क्या हैं?
4. स्वयं ही दवाओं का इस्तेमाल शुरू करने के क्या कारण हैं?
5. दवाओं के बुरे प्रभाव क्या हैं?

# अध्याय-39

# औद्योगिक सूक्ष्म जीव विज्ञान

मानव अपने फायदे के लिए रोगाणुओं या सूक्ष्मजीवों (माइक्रोब्स) का उपयोग सदियों से करता चला आ रहा है। शिल्प विज्ञान के इस युग में इनको उद्योगों में सक्रिय कारकों के रूप में इस्तेमाल किया जा रहा है और आसानी से प्राप्त होने वाली सस्ती व कच्ची सामग्री को अच्छे लाभकारी उत्पादों में रूपान्तरित किया जा रहा है। लेकिन ये सूक्ष्मजैविक प्रक्रम आर्थिक दृष्टि से तभी व्यावहारिक हो पाते हैं जब निम्नलिखित दशाएँ अनुकूल होती हैं :

1. **जीव :** प्रयुक्त जीव को इस योग्य होना चाहिए कि वह उस यौगिक को काफी अधिक मात्रा में उत्पन्न कर सके। इसमें तेजी से अधिक वृद्धि करने का गुण भी होना चाहिए।
2. **माध्यम (मीडियम) :** अवस्तर (सबस्ट्रेट) समेत उस माध्यम को सस्ता व आसानी से उपलब्ध होना चाहिए, जिसका रूपान्तरण प्रयुक्त रोगाणु या सूक्ष्मजीव द्वारा किया जाता है। ऐसे प्रक्रमों (प्रौसेस) के लिए अन्य उद्योगों से प्राप्त अपशिष्ट पदार्थ उपयुक्त माध्यम होते हैं।
3. **उत्पाद :** प्रक्रम के उपरान्त प्राप्त होने वाले उत्पाद की उपलब्धि काफी अधिक मात्रा में होनी चाहिए।

रोगाणुओं या सूक्ष्मजीवों का मुख्य उपयोग इन चीजों के निर्माण में होता है—(क) प्रतिजैविक (ऐन्टिबायोटिक्स), (ख) खाद्य पदार्थ तथा पेय, और (ग) विटामिनों, स्टेरॉइड तथा एंजाइमों समेत कार्बनिक रसायनों के निर्माण में।

## प्रतिजैविक

**प्रतिजैविक** या **ऐन्टिबायोटिक** शब्द आज घर-घर का शब्द हो गया है। यह एक ऐसे सूक्ष्मजीव का उपापचयी (मेटाबोलिक) उत्पाद होता है जो अन्य सूक्ष्मजीवों के लिए हानिकारक होता है। ये प्रतिजैविक पदार्थ अपनी क्रियाशीलता के कारण पृथक किए जाने के पहले ही ज्ञात हो गए थे। चीनी लोग फोड़ों के उपचार में सोयाबीन की फफूंदी वाली दही का प्रयोग करते थे। पास्चर और जौबर्ट ने ऐंथ्रैक्स के बेसिलस (जीवाणु) को मूत्र में खूब वृद्धि करते हुए पाया लेकिन अन्य सूक्ष्मजीवों की उपस्थिति में वे फिर गायब हो गए।

ग्रेशिया और डाथ (1924) की पहली सुव्यवस्थित खोज के परिणामस्वरूप भूमि-कवकों (ऐक्टिनोमाइसिटीज) के विभेदों (स्ट्रेन) में ऐक्टिनोमाइसीटिन का पृथक्करण हुआ। लेकिन इस यौगिक को कभी भी रोगियों के उपचार में इस्तेमाल नहीं किया गया।

सन् 1929 में ऐलेक्जेंडर फ्लेमिंग ने पाया कि फफूंदी से संदूषित **स्टैफाइलोकोकस ऑरियस** के कुछ

संवर्ध (कल्चर) कम वृद्धि कर पाए। विभिन्न क्षेत्रों के बीच सुस्पष्ट रूप से पृथक् मंडल थे जहाँ पर कि जीवाणु (*बैक्टीरिया*) और फफूंदी की **पेनीसिलियम** स्पिसीज के रूप में पहचान की गई। लेकिन फ्लेमिंग की खोज की संभावनाओं और क्षमताओं को दूसरे महायुद्ध के दौरान ही महसूस किया जा सका, और इंगलैन्ड तथा अमरीका के अनुसंधानकर्त्ताओं के अनथक प्रयत्नों से पेनीसिलिन को अलग किया जा सका। पेनीसिलिन नाम भी पेनीसिलियम के आधार पर ही रखा गया। इस प्रकार यह "संदूषक फफूंदी" "चमत्कारी औषधि'' का स्रोत बनी।

इसके बाद तब से अनेक प्रतिजैविक पदार्थ खोजे गए हैं, जिनमें कई आजकल चिकित्सा के लिए प्रयुक्त किए जाते हैं। इनमें सामान्य प्रकार के प्रतिजैविक पदार्थों की सूची उनके उत्पादक जीवों तथा रोगों सहित, परिशिष्ट में दी गई है।

अनेक प्रतिजैविकों के पृथक्करण के बाद भी ये सभी चिकित्सा विज्ञान की दृष्टि से लाभकारी नहीं हैं। वे विशेषताएँ जिनके आधार पर कोई प्रतिजैविक पदार्थ चिकित्सा विज्ञान के लिए उपयोगी होता है निम्नलिखित हैं :

1. ऐसे यौगिक में कई प्रकार के रोगकारी सूक्ष्मजीवों को नष्ट करने या संदमित करने की क्षमता होनी चाहिए। "विस्तृत" प्रतिजैविक का यही मतलब होता है।
2. इसमें परजीवी के प्रतिरोधी प्रकारों के तीव्र परिवर्धन को रोकने की क्षमता होनी चाहिए।
3. इसके द्वारा परपोषी (होस्ट) पर अन्य बुरे प्रभाव नहीं पड़ने चाहिए, जैसे कि संवेदनशीलता या एलर्जी की प्रतिक्रियाएँ, तंत्रिका की क्षति, या वृक्कों (गुर्दों) तथा जठर-आँत्र पथ का उत्तेजन।
4. इसके द्वारा परपोषी के सामान्य सूक्ष्मजैविक वनस्पति जात (फ्लोरा) का नाश नहीं होना चाहिए क्योंकि ऐसा करने से "प्रकृति का संतुलन" गड़बड़ा जाएगा और कुछ रोगकारी जीवाणु पनपने लगेंगे जिनका पनपना 'सामान्य' वनस्पति जात द्वारा रोका जाता है।

मानव-रोगों के उपचार के अतिरिक्त कुछ प्रतिजैविक पदार्थ खाद्य पदार्थों के परिरक्षकों (प्रीज़र्वेटिव) और प्राणियों के भोजन को उपचारित करने के लिए भी इस्तेमाल किए जाते हैं। कुछ प्रतिजैविक पौधों के रोगकारकों (पैथोजेन) के नियंत्रण में भी प्रयुक्त होने लगे हैं। मानव के लिए अनुपयुक्त ग्रिसियोफल्विन सेम के किट्ट रोग (रस्ट) के नियंत्रण में प्रयुक्त होता है। टेट्रासाइक्लीन और स्ट्रेप्टोमाइसिन का अब व्यापक रूप से प्रयोग होता है। इनका अनुप्रयोग (ऐप्लिकेशन) पत्तियों पर या जड़ों पर फुहार के रूप में किया जा सकता है। प्रतिजैविकों का उपयोग कई प्रकार से भोजन के परिरक्षण में भी होता है, विशेष कर ताजा गोश्त और मछली के परिरक्षण में। प्राणियों के आहार में अल्प मात्रा वाले संपूरक भोजन के रूप में प्रतिजैविक उनका परिवर्धन और अच्छी तरह से करते हैं।

## प्रतिजैविकों के उत्पादन की सामान्य विधियाँ

सूक्ष्म जीव का संवर्धन निर्जमित (स्टेरीलाइज्ड) माध्यम में किया जाता है, जिसमें कार्बन, नाइट्रोजन, खनिजों व बफरों के स्रोत के अतिरिक्त उत्पादन में वृद्धि करने वाले पूर्ववर्ती (प्रीकर्सर) भी होते हैं। संवर्धन में उन दशाओं को बनाये रखा जाता है जो प्रतिजैविक की वृद्धि और अधिक उत्पादन के अनुकूल होती हैं। उपयुक्त आरम्भक (स्टार्टर) से संरोपण (इनॉकुलेशन) करने के बाद माध्यम को इष्टतम pH और तापमान पर रखा जाता है। अधिक उत्पादन के लिए वायु मिश्रण या वातन (एयरेशन) जरूरी है। प्रतिफेन कारकों द्वारा फेन या झाग बनने पर नियंत्रण रखा जाता है। उत्पादन बढ़ाने के लिए किण्वन (फरमेन्टेशन) के दौरान बीच-बीच में कुछ संघटकों (इनग्रेडिएन्ट) को अल्प मात्रा में मिलाया जा सकता है, जैसे शर्करा, पूर्ववर्ती (प्रीकर्सर) आदि का ताकि वह सूक्ष्मजीव के लिए विषैला न बन जाय।

इस प्रकार से उत्पन्न प्रतिजैविक सामान्यतया माध्यम में उत्सर्जित किए जाते हैं, जो मुक्त शेष (स्पेन्ट) माध्यम में कोशिकाओं और पदार्थों के आयतन की अपेक्षा मात्रा में बहुत कम होते हैं। प्रक्रम के दो चरण होते हैं—पहले

में निस्यंदन यानी छानने या अपकेन्द्रण (सेन्ट्रिफ्यूजिंग) से कवकजाल (माइसीलियम) और कोशिकाओं का निराकरण होता है और दूसरे चरण में विलायक-निष्कर्षण (सौलवेन्ट एक्स्ट्रैक्शन), अधिशोषण या अवक्षेपण द्वारा माध्यम से प्रतिजैविक का निराकरण शुद्ध किए गए उत्पाद को उपयुक्त प्रकार के जीवाणु निस्यन्दकों (बैक्टीरियल फिल्टर) से छानकर पाइरोजेन—मुक्त कर दिया जाता है। फिर इस उत्पाद की क्षमता का जैवआमापन किया जाता है जिसमें तुलना के लिए मानकों (स्टैन्डर्ड) का प्रयोग किया जाता है।

## खाद्य पदार्थ और पेय

सदियों से खाद्य पदार्थों और पेयों के निर्माण में सूक्ष्मजीवों ने महत्वपूर्ण रोल अदा किया है। लेकिन बड़े पैमाने पर इनका औद्योगिक उपयोग आधुनिक शिल्प-विज्ञान की ही देन है। ऐसे अनेक उत्पादों में मुख्य हैं—चीज, डबल रोटी, खाद्य खमीर, मट्ठा या छाछ, एल्कोहलीय पेय, सिरका, सोय सॉस आदि।

### चीज

एशिया और यूरोप में ईसा के जन्म से काफी पहले ही चीज तैयार की जाती थी। चीज बनाने के लिए भेड़, बकरी, गाय, घोड़ी तथा अन्य जानवरों से प्राप्त दूध का इस्तेमाल किया जाता था। चीज के निर्माण में निम्नलिखित चरण सम्मिलित हैं :

(क) ताजे दूध में रेनेट समेत लैक्टिक एसिड बैक्टीरिया डालकर दूध को जमाना (रेनेट में रेनिन *नामक एंजाइम होता है, और इसे गाय के आमाशय या* पेट से प्राप्त किया जाता है)। स्कंदन या जमाने से तैयार किया गया पदार्थ द्रवीय अंश या छेने के पानी (ह्वे) से अलग कर लिया जाता है।

(ख) नमी अलग करने के लिए जमे पदार्थ का फिर संसाधन किया जाता है। यदि इस अवस्था में चीज का इस्तेमाल होता है तो इसे काटेज चीज (पनीर) कहते हैं।

(ग) लवणन (साल्टिंग) अगला चरण है। यह कार्य सतह को नमक से रगड़ कर और नमक के पानी में चीज को डुबोकर किया जाता है। लवण द्वारा दो कार्य होते हैं · एक तो, इससे नमी और कम कर दी जाती है और दूसरे, अवांछित सूक्ष्मजीवों की वृद्धि नहीं हो पाती।

(घ) चीज बनाने के लिए जमे दूध का 'पक्वन' एक विशेष कक्ष में किया जाता है, जिसे उचित तापमान तथा नमी पर रखा जाता है। बनाई जाने वाली चीज के विभिन्न प्रकारों के अनुसार किण्वन (फरमेन्टेशन) करने वाले सूक्ष्मजीव जमाने वाली या इस अवस्था में लैक्टिक एसिड बैक्टीरिया के साथ मिला दिए जाते है। इससे चीज की हर किस्म अपनी अलग सुवास और स्वाद वाली हो जाती है। ये सूक्ष्मजीव प्रोटीनलयी (प्रोटियोलिटिक) तथा वसालयी (लाइपोलिटिक) क्रियाशीलता को उत्प्रेरित करते है। पक्वन अवधि 1 महीने से लेकर *16 महीने तक की होती* है। चीज *बहुत* अधिक पोषक होती है क्योंकि इसमें 20 से 30% वसा, 20 से 35% प्रोटीन और अल्प मात्रा में खनिज होते है।

### ब्रेड या डबल रोटी बनाना

डबल रोटी का किण्वन करने के लिए खमीर (यीष्ट) का उपयोग यहूदियों, यूनानियों और रोमनों द्वारा बहुत पहले से होता रहा है। यह विधि आज भी प्रचलित है, जिसमें बस जरा सा परिवर्तन हुआ है। आटे की लोई में *सैक्केरोमाइसीज सेरीविसिई* के चुने विभेद (स्ट्रेन) मिला दिए जाते हैं। किण्वन से कार्बन डाइऑक्साइड गैस बनती है जो लोई के अन्दर से ऊपर उठती है और इच्छित गठन तथा सुवास ले आती है।

### खाद्य खमीर

मानव के लिए खमीर बहुत अधिक पोषण प्रदान करने वाला पदार्थ है, जिसे संपूरक खाद्य के रूप में प्रायः ही इस्तेमाल किया जाता है। यह बी विटामिनों और प्रोटीनों (कुल पदार्थ का 40 से 50%) का बहुत अच्छा स्रोत है। खाद्य खमीर निसवन उद्योग (ब्रुइंग इन्डस्ट्री) के उप-उत्पाद के रूप में प्राप्त होती है और इसे शीरे, शर्करा, आलू तथा अन्य किण्वन योग्य कार्बोहाइड्रेट वाले माध्यमों में भी संवर्धित किया जाता है। कागज और लुगदी के निर्माण में सेलुलोज के अतिरिक्त अन्य कार्बोहाइड्रेटों वाली अपशिष्ट सल्फाइट लिकर खमीर की टोरूलोप्सिस युटिलिस नामक जाति के संवर्धन के लिए उपयुक्त

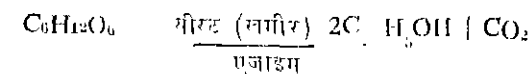
माध्यम होती है। ऐसे माध्यमों में खमीर को तब तक संवर्धित किया जाता है जब तक कि अधिकतम कोशिकाओं का उत्पादन नहीं हो जाता। इसके बाद इसे एकत्र करके धोया, सुखाया व बाजार में पहुँचा दिया जाता है।

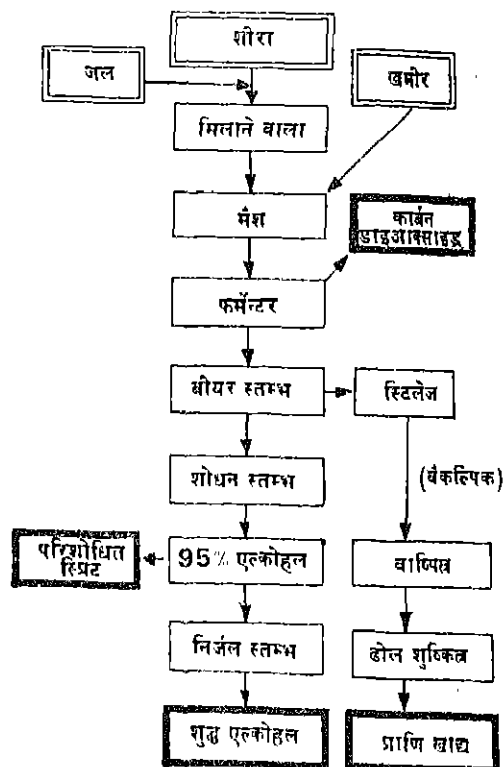
## मट्ठा और दही

हमारे देश में ये पदार्थ या उत्पाद सामान्यतया घरों में बनाए जाते हैं लेकिन पश्चिमी देशों में इनका उत्पादन बड़े पैमाने पर करके इन्हें दुकानों पर बेचा जाता है। मट्ठे के लिए आरम्भक संवर्धन के रूप में **स्ट्रेप्टोकोकस लैक्टिस या स्ट्रे० क्रीमोरिस** और *ल्यूकोनोस्टक सिट्रोवोरम* या **ल्यू० डेक्स्ट्रेनम** का इस्तेमाल किया जाता है। बाद वाले आरम्भक पदार्थों से वाष्पशील अम्ल तथा उदासीन उत्पाद बनते हैं, जिससे मट्ठे का अपना एक अलग स्वाद हो जाता है। दही के आरम्भक संवर्धों में **स्ट्रेप्टोकोकस थर्मोफिलस** और **लैक्टोबेसिलस बल्गेरिकस** होते हैं।

## एल्कोहॉलीय पेय

एल्कोहॉलीय पेय शर्कराओं में खमीर वाले किण्वन से बनाए जाते हैं। पेय को एक विशेष सुवास व स्वाद देने के लिए सामान्यतया विभिन्न कार्बोहाईड्रेट स्रोतों का प्रयोग किया जाता है, जैसे बीयर (जौ—माल्ट), वाइन (अंगूर) आदि में। सामान्यतया प्रयुक्त होने वाली यीस्ट या खमीर सैक्केरोमाइसीज सेरीविसिई है। जीवरासायनिक अभिक्रिया नीचे लिखे प्रकार से दी जाती है।

$$C_6H_{12}O_6 \xrightarrow[\text{एंजाइम}]{\text{यीस्ट (खमीर)}} 2C_2H_5OH + CO_2$$

ग्लूकोज एथिल एल्कोहॉल + कार्बन डाईऑक्साइड

एल्कोहॉलीय पेयों के अलावा इस प्रक्रिया से किसी भी किण्वनीय कार्बोहाइड्रेट से एथिल एल्कोहॉल भी निर्मित किया जाता है। स्रोत के रूप में यदि मंड पदार्थ का प्रयोग होता है तो इनका पहले सरल शर्कराओं में जलापघटन (हाईड्रोलाइजेशन) होना चाहिए और यह जौ माल्ट, फफूंदियों या अम्लित माध्यम के ताप-उपचार द्वारा सम्पन्न किया जाता है। इसमें कच्ची सामग्री के रूप में आलू, शीरे, अपशिष्ट सल्फाइट लिकर व काष्ठ शर्कराओं का प्रयोग किया जाता है। इसके निर्माण की योजना चित्र 39.1 में दिखलाई गई है।

चित्र 39.1 : शीरे से एल्कोहॉल के निर्माण का सरलीकृत प्रक्रम चित्र (फ्लो शीट)।

## सिरका

सिरका वह मसाला है जो दो चरण वाली किण्वन-प्रक्रिया द्वारा शर्करा युक्त या मंडयुक्त पदार्थ से बनाया जाता है। पहले यीस्ट-किण्वन से शर्करा वाला या मंड वाला पदार्थ एल्कोहॉल में बदल दिया जाता है और फिर एसीटिक अम्ल वाला किण्वन (फरमेन्टेशन) होता है। फ्रांसीसी भाषा में 'विनेगर' शब्द का शाब्दिक अर्थ है "खट्टी वाइन"। यह जिस उत्पाद से प्राप्त होता है उसी के आधार पर इसका नाम रखा जाता है, जैसे सेब का आसव (साइडर) या सेब का सिरका, वाइन या अंगूर का सिरका, माल्ट विनेगर आदि। यद्यपि सिरके को सेब

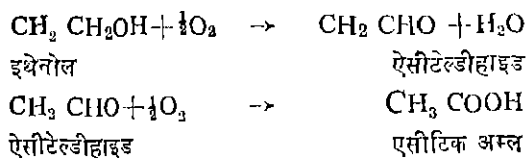
हजारों साल पहले से जानते हैं, लेकिन लोगों को यह मालूम नहीं था कि यह रोगाणुओं या सूक्ष्मजीवों (माइक्रोब) के द्वारा बनता है । सन् 1837 में कुट्‌जिंग ने खोज करके इस बात को उद्‌घाटित किया । बाद में सन् 1868 में पास्तेर ने शरीर क्रियात्मक प्रकिया के रूप में इसकी पुष्टि की ।

सिरके के निर्माण में यीस्ट या खमीर (**सैक्करोमाइसीज सेरीविसिई** की किस्में) द्वारा अवस्तर या सबस्ट्रेट का एल्कोहॉलीय किण्वन होता है । किण्वन पूरा हो चुकने के बाद **निःसादन** (सेटलिंग) द्वारा यीस्ट की लुगदी और अन्य तलछट अलग कर ली जाती है । ऊपर वाले द्रव का किण्वन एसीटिक बैक्टीरिया के द्वारा होता है । इसमें इष्टतम एल्कोहॉलीय सांद्रता 10-13% होती है । अभिक्रिया निम्नलिखित प्रकार से सम्पन्न होती है :

$$CH_3\,CH_2OH + \frac{1}{2}O_2 \rightarrow CH_3\,CHO + H_2O$$

इथेनोल → ऐसीटेल्डीहाइड

$$CH_3\,CHO + \frac{1}{2}O_2 \rightarrow CH_3\,COOH$$

ऐसीटेल्डीहाइड → एसीटिक अम्ल

सिरके का किण्वन तब तक चलने दिया जाता है जब तक कि अधिकतम सांद्रता नहीं हो जाती । फिर आगे होने वाले अवक्रमण को रोकने के लिए द्रव को अवायवीय प्रकार से जमा करके रखा जाता है । भंडारण के दौरान काल-प्रभावन (एजिंग) होता है, ईस्टर बनते हैं और कड़ा स्वाद गायब हो जाता है । फिर छान कर सिरका साफ कर लिया जाता है, और उसका पास्तेरीकरण करके बोतलबंदी कर ली जाती है ।

## कार्बनिक रसायन और एंजाइम

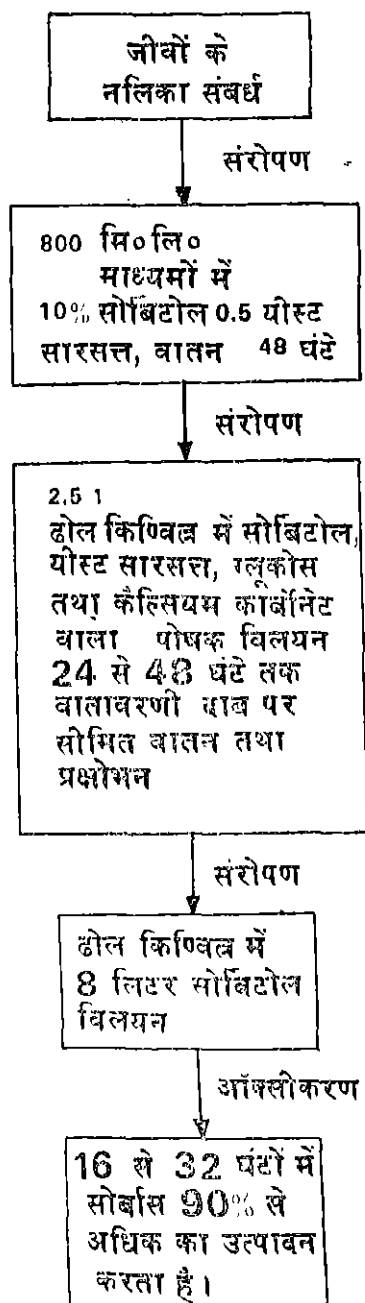
सूक्ष्मजीवों के प्रयोग से कई कार्बनिक रसायनों को औद्योगिक रूप से उत्पन्न किया जाता है । इनमें मुख्य हैं— कार्बनिक अम्ल, विटामिन व विटामिनों के पूर्ववर्ती (प्रीकर्सर), डेक्स्ट्रैन, स्टेरॉइड, और एंजाइम ।

### 1. कार्बनिक अम्ल

कुछ सामान्य प्रकार के कार्बनिक अम्ल औद्योगिक रूप में सूक्ष्मजीवों द्वारा तैयार किए जाते हैं । इस संदर्भ में एसीटिक अम्ल-किण्वन (देखो सिरका) का वर्णन पहले किया जा चुका है । किण्वन प्रक्रियाओं द्वारा तैयार किए जाने वाले व्यापारिक महत्व के अन्य अम्लों की सूची अनुप्रयोग सहित, सारणी 39.1 में दी गई है ।

### 2. विटामिन और विटामिनों के पूर्ववर्ती (प्रीकर्सर)

विटामिन बी (B) के स्रोत के रूप में खाद्य खमीर का वर्णन पहले ही किया जा चुका है । इसके अलावा, विटामिन बी$_{12}$ यानी जल में घुलने वाला कोबलमिन नामक विटामिन भी सूक्ष्मजीवों द्वारा उत्पन्न होता है । विटामिन बी$_{12}$ मुख्यतया जीवाणुओं (बैक्टीरिया) और ऐक्टिनोमाइसिटीज द्वारा उत्पन्न होता है, जबकि फफूंदियाँ और खमीर नहीं । व्यापारिक स्तर पर इस्तेमाल होने वाले जीव हैं **स्ट्रेप्टोमाइसीज ओलिवेसियस** और **बैसिलस मेगाथीरियम** जो कार्बन स्रोत वाले मक्का-शर्करा या मक्के की चाशनी अथवा ईख के शीरे के माध्यमों में उगाए जाते हैं । विटामिन का सान्द्रण कोशिकाओं में होता है । अधिकतम वृद्धि के बाद कोशिकाओं को अपकेन्द्रण (सेन्ट्रीफ्यूगेशन), निस्यन्दन (छानने) अथवा निथारने से बटोर लिया जाता है और फिर सुखा कर या बिना सुखाए हुए प्राणियों के संपूरक खाद्य या चारे के रूप में प्रयुक्त किया जाता है । चिकित्सा के प्रयोजन के लिए 100° सेंटीग्रेड पर कोशिकाओं के स्वलयन (ऑटोलिसिस) से विशुद्ध विटामिन की प्राप्ति की जाती है, जबकि विटामिन जलीय अवस्था में निकलता है और जहाँ से उसे सान्द्रित करके शुद्ध कर लिया जाता है । विटामिन बी$_{12}$ ($B_{12}$) प्राणि खाद्य को संपूरित करने, तथा मानव में अरक्तता (ऐनीमिया) का उपचार करने और भूख खोलने में प्रयुक्त किया जाता है ।

**राइबोफ्लेविन** (विटामिन बी$_2$)—कई सूक्ष्मजीवों से तैयार किया जाता है, जैसे कि खमीरों (यीस्टों), यीस्ट जैसे सूक्ष्मजीवों (**ऐशबिया गौसिपियाइ, एरीमोथीसियम ऐशबियाई**) तथा जीवाणुओं के द्वारा । व्यापारिक स्तर पर यह **ऐ० गौसिपियाई, ए० ऐशबियाई, क्लोस्टेरीडियम ब्यूटाइरिकम** और **क्लो० एसीटो ब्यूटाइलिकम** से तैयार किया जाता है । अवस्तर से राइबोफ्लेविन ब्यूटेनोल के साथ विलायक निष्कर्षण विधि से, मुल्तानी मिट्टी अथवा सिलिकाजेल में अधिशोषण की विधि से प्राप्त किया जाता है । शुद्ध रूप में यह कड़वा,

चित्र 39.2 : सोर्बिटोल से सोर्बोस के उत्पादन का प्रक्रम चित्र ।

गंधहीन, रवेदार, पीले नारंगी रंग का चूर्ण होता है। मानव के लिए वृद्धि और जनन के लिए राइबोफ्लेविन जरूरी है । एस्कोर्बिक अम्ल का पूर्ववर्ती (प्रीकर्सर) एल-सोर्बोज (L-Sorbose) व्यापारिक स्तर पर जैविक डिहाईड्रोजनीकरण (डी हाईड्रोजनेशन) द्वारा डी-सौर्बिटोल (D-Sorbitol) द्वारा तैयार किया जाता है। जो जीव इस प्रकार का रूपांतरण करते हैं वे ऐसीटोबैक्टर के विभिन्न प्रकार हैं । उत्पादन का प्रक्रम-चित्र (फ्लो चार्ट) चित्र 39.2 में दिया गया है । एल-सोर्बोज (L-Sorbose) को फिर विटामिन सी (C) के निर्माण में इस्तेमाल किया जाता है।

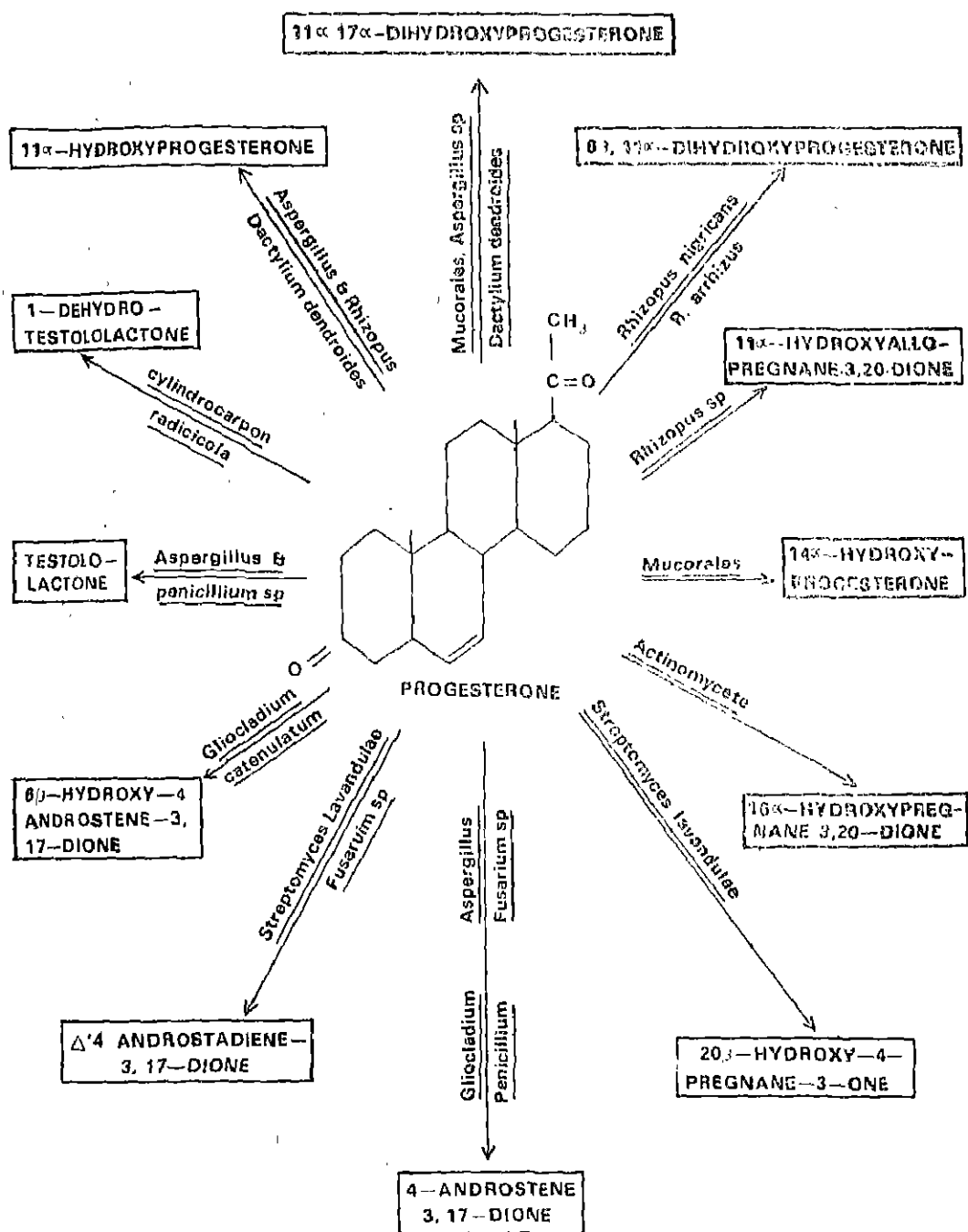
### 3. डेक्स्ट्रैन

आयुर्विज्ञान में डेक्स्ट्रैन विशेष महत्व के पदार्थ हैं क्योंकि ये रुधिर प्लाज्मा आयतनवर्धी (एक्सटेन्डर) के रूप में प्रयुक्त होते हैं । ये डी-ग्लूकोज (D-Glucose) के बहुलक या पोलीमर और पोलीग्लूकुसैन भी हैं। डेक्स्ट्रैन किण्वन प्रक्रियाओं या डेक्स्ट्रैनसुक्रेस नामक एंजाइम के उपयोग से भी तैयार किए जा सकते हैं, जो कि खुद भी व्यापारिक स्तर पर सूक्ष्मजीवों से प्राप्त किया जाता है । एंजाइमीय प्रक्रिया से यह फायदा है कि इससे चिकित्सीय उपयोग के लिए उपयुक्त आणविक भार वाले डेक्स्ट्रैन को सीधे ही काफी कुछ मात्रा में तैयार किया जा सकता है। औद्योगिक रूप में ल्यूकोनास्टक मेसेन्टेरॉइडीज को उपयुक्त आणविक आकार वाले डेक्स्ट्रैन में तैयार करने में प्रयुक्त किया जाता है ।

### 4. स्टेरॉइड

स्टेरॉइड जटिल कार्बनिक अणु हैं जिनमें मानव के हॉरमोन और कार्टिसोन शामिल हैं । परिवार-नियोजन तथा असाध्य रोगों के उपचार में इनका बहुत इस्तेमाल हो रहा है । ये स्टेरॉइड रसायनों और सूक्ष्मजैविक विधियों के संयोग से बनाए जाते हैं। प्रोजेस्टरोन को अन्य स्टेरॉइडों में रूपांतरित किया जा सकता है और प्रयुक्त सूक्ष्मजीव के प्रकार के आधार पर सही उत्पाद का निर्धारण किया जाता है (चित्र 39·3)।

### 5. एंजाइम

रोगाणु या सूक्ष्मजीव भी विभिन्न एंजाइमों के स्रोत हैं, जिनका उद्योगों में व्यापक रूप से प्रयोग होता है ।

चित्र 39.3 : सूक्ष्मजैविक रूपान्तरण द्वारा प्रोजेस्टरोन से उत्पन्न कुछ स्टेरॉइड।

इनमें से सबसे आम उपयोग है लैक्टिक और एसीटिक अम्ल बनाने में। औद्योगिक सूक्ष्मजीवविज्ञान के उपयोग वाले अन्य प्रक्रमों से प्राप्त अपशिष्ट पदार्थों को लैक्टिक अम्ल के निर्माण में कच्ची सामग्री के रूप में इस्तेमाल किया जाता है, जैसे कि छेने का पानी (ह्वे) जो कि चीज़ के निर्माण में अपशिष्ट के रूप में बच रहता है। व्यापारिक स्तर पर तैयार किए जाने वाले सूक्ष्मजैविक एंजाइम और उनके उपयोग सारणी 39·2 में दिए गए हैं।

## सारणी 39.1

### औद्योगिक रूप में सूक्ष्मजीवों से तैयार किए जाने वाले कार्बनिक अम्ल और उनके उपयोग

| अम्ल | जीव | कच्ची सामग्री | अनुप्रयोग |
|---|---|---|---|
| 1. लैक्टिक अम्ल | **लैक्टोबैसिलस डेलब्रूकियाई लै० बलगेरिकस** तथा **स्ट्रेप्टोकोकस लैक्टिस** | अम्ल द्वारा जल अपघटित, मक्का-मंड या आलू, छेने का पानी, शीरा, अपशिष्ट सल्फाइट लिकर, तथा प्रयुक्त जीवों के अनुसार पोषक पदार्थ। | लैक्टिक अम्ल की खायी जाने वाली किस्म का प्रयोग कनफेक्शनरी के सारसत्त, फलों के रस, सार, लेमोनेड, अचार, मांस के संसाधन, डब्बे में बन्द सब्जियों, व मछली के उत्पादों मे होता है जहाँ इसे परिरक्षक के रूप में इस्तेमाल किया जाता है। इसे फीनोल पेयों के निर्माण, रेशम व अन्य वस्त्रों को रंगने, गरम कपड़ों की छपाई में रंगबंधक के रूप में, चमड़ा उद्योग में खाल के विचूर्णन (डिप्ला-इंगिग), तथा चमड़ा कमाने, टाँके के फ्लक्स के रूप में, प्लास्टिक उद्योग में प्रयुक्त किया जाता है। लैक्टिक अम्ल के लवणों का भी व्यापक रूप से उपयोग किया जाता है। |
| 2. एसीटिक अम्ल | **ऐसीटोबैक्टर** स्पी० | फल, शर्करा जिसमें चाशनी और जलअपघटित मंड पदार्थ होता है। | एसीटिक अम्ल का सिरके तथा अन्य औद्योगिक पदार्थों के निर्माण में उपयोग होता है। |
| 3. साइट्रिक अम्ल | **ऐस्पर्जिलस नाइगर** | शर्करा | (i) दवाइयों में, (ii) सुवास वाले सारसत्तों में, (iii) खाद्य पदार्थों व कैंडी में, (iv) स्याही बनाने में, (v) रंगाई में, (vi) नक्काशी में। |
| 4. ग्लूकोनिक अम्ल | **ऐ० नाइगर, पेनीसिलियम परप्यूरोजीनम** तथा **पे० क्राइसोजेनिन** | | (i) औषधियों में। (ii) कैल्शियम ग्लूकोनेट शिशुओं व गर्भिणी स्त्रियों के पोषण में कैल्शियम के स्रोत के रूप में तथा अधिक उत्पादन करने वाली डेयरी की गायों में दुग्ध-ज्वर (मिल्क-फीवर) का उपचार करने में काम आता है। |
| 5. 5-केटो ग्लूकोनिक अम्ल | **ऐसीटोबैक्टर सबआक्सीडेन्स** | ग्लूकोस | टार्टरिक अम्ल का मध्यवर्ती |
| 6. 2-केटो ग्लूकोनिक अम्ल | स्यूडोमोनास स्पी० | ग्लूकोस, ग्लूकोनिक अम्ल | डी-ऐरेबोऐस्कोर्बिक अम्ल का मध्यवर्ती |

## सारणी 39.2

### सूक्ष्मजैविक एंजाइम और उनके अनुप्रयोग

| एंजाइम | जीव | अनुप्रयोग |
|---|---|---|
| 1. एमिलेस | बैसिलिस सबटिलिस, बैं० मैसरेन्स, बैं० पोलिमिक्सा ऐस्पर्जिलस नाइगर, ऐ० ओरिजी, राइज़ोपस ओरिज़ी | α एमिलेस—(i) मंड का द्रवण तथा शर्करीकरण<br>(ii) चाकलेट की चाशनी के गाढ़ेपन में कमी।<br>(iii) मंड से फल के रस में गंदलापन हो जाने से उसकी सफाई।<br>(iv) वस्त्रों का विचिक्कणन (डीसाइज़िंग),<br>(v) कागज़ का चिक्कणन (साइज़िंग)<br>(vi) वस्त्रों का चिक्कणन तथा विचिक्कणन<br>β एमिलेस—(i) मक्के की चाशनी बनाना,<br>(ii) बेकरी-उद्योग में डो (dough) का रूपांतरण,<br>(iii) पाचक एंजाइमों की कमी को पूरा करना। |
| 2. साइटेस | बै० सबटिलिस | |
| 3. सेलुलेस | माइरोथिसियम वेरुकेरिया | |
| 4. डेक्स्ट्रैन सुक्रेस | ल्यूकोनास्टक मेसेन्टेरॉइडीज़ | डेक्स्ट्रैन का उत्पादन,<br>फ्रक्टोस का उत्पादन। |
| 5. ग्लूकोस आक्सिडेस (नोटेटिन या पीला एंजाइम) | पेनीसिलियम नोटेटम | ग्लूकोस की उपस्थिति में ऑक्सीजन का निराकरण, खाद्य उत्पादों से ग्लूकोस का निराकरण (जैसे सूखने से पहले अंडे) |
| 6. इनवर्टेस | सैकेरोमाइसीज़ सेरीविसिई, सैं० एक्सिगुअस | कैन्डी में मृदु केन्द्रों का निर्माण |
| 7. लैक्टेस | सैं० फ्रेजिलिस, टोरुला क्रीमोरिस | डेयरी-उत्पादों में, जैसे कि आइसक्रीम, संसाधित चीज आदि में, बालू-जैसे किरकिरेपन से बचाव। |
| 8. लाइपेस | कैन्डिडा लिपोलिटिका, ऐ० लुचुएन्सिस | पास्तेरीकृत दूध से चीज़ बनाना। |
| 9. पेक्टिनेस | बाइसोक्लैमिस फल्वो | (i) फलों के रस और एंजाइमों की सफाई।<br>(ii) हरी कॉफी का निर्माण<br>(iii) फलों के उत्पादों के छानने में तेजी लाना।<br>(iv) सन के निर्माण में आतसी (फ्लैक्स) का गलाना। |
| 10. पेनीसिलिनेस | बा० ब्रेविस, ऐक्टिनोमाइसीज कैन्डिडस | पेनीसिलिन की प्रतिजैविक क्रिया की समाप्ति। |
| 11. प्रोटिएस | मॉर्टिएरैला रेनीस्पोरा | (i) केसीन, लैक्टेलबुमेन, जिलेटीन तथा अन्य प्रोटीनों का द्रवण तथा जल अपघटन<br>(ii) जिलेटिन के साइज़ों की समाप्ति।<br>(iii) बीयर को अतिशीत सह बनाना।<br>(iv) भीगी खाल से बाल छुड़ाना।<br>(v) दाग अलग करना।<br>(vi) द्रवीय गोंद का निर्माण।<br>(vii) रेशम को गोंद रहित करना। |

# अभ्यास

1. प्रतिजैविकों (एन्टिबायोटिकों) के उन सामान्य गुणों का विवेचन करो जो उन्हें चिकित्सा के लिए उपयोगी बनाते हैं।
2. निम्नलिखित पदार्थों के निर्माण से सम्बद्ध सूक्ष्मजीवों के नाम बतलाओ।
   (1) सिरका (2) एल्कोहॉल (3) टैट्रासाइक्लीन (4) साइट्रिक अम्ल ।
3. रोगाणु या सूक्ष्मजीव उद्योगों के अपशिष्ट पदार्थों का उपयोग करके हमारी मदद करते हैं—इस कथन की पुष्टि करो ।
4. दूध के उत्पादों के संसाधन में सूक्ष्मजीवों के उपयोगों का वर्णन करो।
5. 'खाद्य तथा पेय उद्योग में खमीर' विषय पर लघु निबन्ध लिखो।
6. निम्नलिखित पदार्थों के निर्माण और उपयोगों पर टिप्पणियाँ लिखो : (क) दही, (ख) डेक्स्ट्रैन, (ग) स्टेरॉइड ।

# परिशिष्ट

## कुछ सामान्य प्रतिजैविक, उनको उत्पादित करने वाले जीव और जीव जिनके प्रति ये क्रियाशील होते हैं

| प्रतिजैविक | उत्पाद करने वाला जीव | संवेदनशील जीव |
|---|---|---|
| 1. पेनीसिलिन | पेनीसिलियम नोटेटम | ग्रैम-ग्राही बैक्टीरिया, नेसेरिया, स्पाइरोकीटिओ, ऐक्टिनोमाइ-सिटीज, क्लोस्ट्रीडिया, कोराइनबैक्टीरियम डिफ्थीरिई । |
| 2. स्ट्रेप्टोमाइसिन | स्ट्रेप्टोमाइसीज ग्रिसियस | ग्रैम-ग्राही और ग्रैम अग्राही बैक्टीरिया, माइकोबैक्टीरियम ट्यूबर-कुलोसिस, ऐक्टिनोमाइसिटीज |
| 3. बेसिट्रेसिन | बैसिलस लाइकेनीफार्मिस | ग्रैम-ग्राही (ग्रैम पाजिटिव) बैक्टीरिया, क्लोस्ट्रीडिया, ट्रेपोनीमा हिस्टोप्लाज्मा कैप्सुलेटम । |
| 4. क्लोरामाइसीज वेनेजुएली | स्ट्रेप्टोमाइसीज वेनेजुएली | ग्रैम-ग्राही और ग्रैम-अग्राही (ग्रैम नेगेटिव) बैक्टीरिया, रिकेट्सी तथा बड़े वाइरस, एन्डोमीबा, बोरेलिया, ऐक्टिनोमाइसीज बोरिस, |
| 5. क्लोरोटेट्रा-साइक्लीन | स्ट्रेप्टोमाइसीज ऑरियोफेसिएन्स | ग्रैम-ग्राही और ग्रैम-अग्राही ओरियोफेसिएन्स बैक्टीरिया, रिकेट्सी और बड़े वाइरस । |
| 6. टेट्रासाइक्लीन | क्लोरोटेट्रासाइक्लीन का उत्प्रेरक हाइड्रोजनीकरण (कैटालिटिक हाइड्रोजनेशन) | क्लेबसिएला न्यूमोनिई, एक प्रकार का स्ट्रेप्टोकोकस नाइटिस; साल्मोनेला टाइफोस, पास्चूरेला मल्टोसिडा, कुछ स्टेफाइलो-कोकस । |
| 7. एरिथ्रोमाइसीन | स्ट्रेप्टोमाइसीज एरिथ्रीरियस | ग्रैम-ग्राही बैक्टीरिया, कुछ ग्रैम-अग्राही बैक्टीरिया, रिकेट्सी और बड़े वाइरस । |

7 Schoolroom air should be kept as clean as possible Gases and malodors are disagreeable and also often harmful

8. A temperature of 65° with slight movement of air is better than a temperature of 70° with considerable movement of air

9 In using window ventilation associated with gravity-exhaust ducts, it is suggested that a large thermometer with a danger signal pointed at 68° should occupy a prominent place for the teacher's constant use.

10 When the temperature out of doors is below 68°, the schoolroom temperature should not average above 68° A schoolroom temperature that changes from 65° to 70° is better than a constant condition.

**The teacher's good judgment.** A rural teacher will not be able to operate the heating and ventilating system successfully unless she is intelligent, alert, and uses good judgment It will be necessary for her to understand the basic principles which underlie the working of the jacketed stove, for every patented plant, whether a room-heater or a furnace in the basement below, operates according to the well-recognized principles of physics In order that the air in the rural schoolroom may be about right hour by hour it will be needful for the teacher to exercise her stove sense, her temperature sense, and her air sense By the term sense as used here the author means both knowledge and the habit of sensitiveness or alertness relative to stove, temperature, and air conditions It is not intended that the teacher consult her personal feelings, rather that she have the habit of consulting the thermometer, noting the condition of the fire, whether the fresh and foul air dampers are open, and in other ways knowing and controlling the situation. It often happens that girls who are graduates of high schools and of rural-teacher training institutions do not possess that practical knowledge and experience which enable them to look after the heating and ventilating of their rooms as it should be done

A teacher who has stove sense understands the construction of a stove, the function of checks and dampers, the need for getting air up through the grate and the fire bed; she knows how to start a fire quickly and effectively Her temperature sense is such, if she is alert and watchful, that she will quickly

note whether the temperature runs much above or below 68°. Moreover, she does not trust to her feelings, but habitually and often consults the thermometer. She does this naturally, with no fuss or trouble. If she lacks the temperature sense or is careless in such matters, the room will either be too hot or too cold most of the time and the pupils will suffer. Her air sense makes her conscious of foul air, she knows that in a room full of children the air very soon gets bad. She should occasionally step to the door and take a few whiffs of fresh air. She will then sense the close, stuffy, foul smell when she returns to the room.

The teacher with temperature sense will be vigilant as to conditions no matter whether she is thin or fleshy, because she is intelligent and has formed the habit. Of course a thin person unquestionably feels cold more quickly than a fleshy one does, a plump person feels warm more quickly than a thin one does. But neither will rely on feeling alone, if she has the habit of due care for the welfare of all. Many rural teachers dress much lighter than the pupils, this is an important element in the temperature situation. Many children wear too much clothing, some teachers don't wear enough. In any case, the temperature should be kept about 68°, it is not difficult for all to become habituated to that temperature.

**Combined smoke-stack and vent flue**

A. Stovepipe.
B. Cast-iron smoke-stack
C. Vent flue
D. Wing register
E. Soot vent

**Self-explanatory diagrams.** The purpose of the diagrams is to show the essential parts of the system and to make plain just why and how the air circulates. It should be understood that

present practice places the vent flue not far from the fresh-air intake in a corner of the room, in order to secure the most

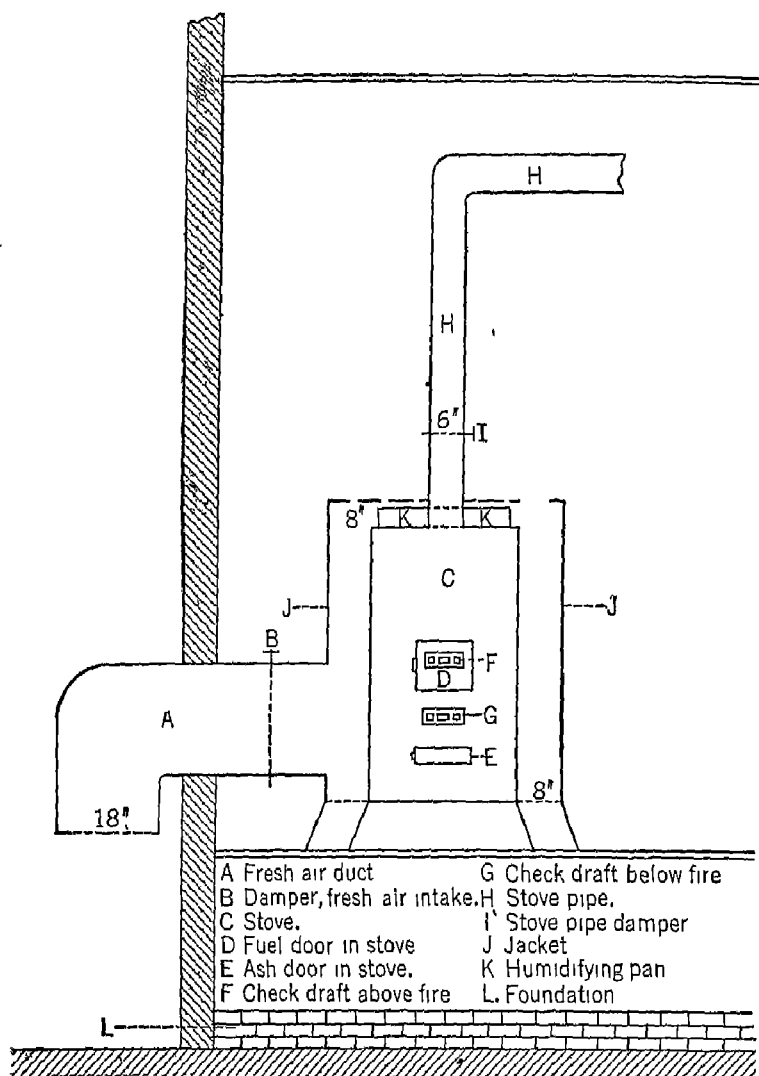



**Diagram showing construction of the jacketed stove and fresh-air duct**

satisfactory circulation of air in the room Note that there are two separate diagrams, one of the stove and the jacket and the

other of the combined smokestack and vent flue See that the parts of the system are properly assembled in one corner of the room, which is the northwest corner in several states, with the stovepipe, fresh-air intake, and vent flue properly adjusted, and that conditions are established for the system to operate successfully In many rural schools the smoke flue and the foul-air or vent flue are combined This will work satisfactorily providing the brick chimney is large enough and the smokestack closed tightly at the bottom, so as not to connect with the foul-air duct. When the two open freely into each other the stove will not draw well on certain days, and of course there will be trouble with the soot. In some rural schools a large galvanized iron pipe used as the vent flue extends down to within a foot of the floor and up through ceiling and roof The warm air of the room heats this foul-air duct, producing a fair circulation of air If this foul-air vent is heated directly by hot air or hot smoke from the stove, it will work much better, if it is connected directly with the smoke flue, it will act as a damper, preventing a good draft The diagrams have been drawn to scale so that the relative sizes and proportions of the various parts may be noted. Note the figures giving dimensions The parts are lettered and named, the description of them is given in the following section Send to the Waterman-Waterbury Company, and to the Smith System Heating Company, both of Minneapolis, for their illustrated descriptive literature, which will shed much light on this entire subject of heating and ventilation

**Jacketed stove and associated flues.** The first item is the stove itself, which is usually cylindrical in shape. This stove is now made to burn either wood or coal It should be equipped with the means for evaporating plenty of water each day This means that the water must be kept steaming if the air is to be supplied with enough moisture This is particularly true on cold winter days when the temperature outside is much lower than in the schoolroom The greater the difference in temperature, the greater the need for evaporating water in the room.

The stove is provided with a full set of checks and dampers so that the fire can be fully controlled

Eight inches from the stove a galvanized iron jacket extends above it several inches and down to within about eight inches of the floor. This jacket is usually lined with asbestos, kept in place by an inner lining of strong tin, thus preventing the jacket from getting too hot

The fresh-air intake should be not less than eighteen inches in diameter; larger if over thirty pupils are in the school This, too, is made of galvanized iron, and opens into the space between the jacket and the stove It is firmly fastened to the jacket so that the joints are airtight This fresh-air intake is now usually passed through the side of the building, but sometimes it comes up under the floor and opens into the jacket from below In the latter case the intake should open some distance above the lower part of the jacket to prevent cold air from blowing over the floor. This fresh-air intake is provided with a tight-fitting damper so that the amount of fresh air admitted can be fully controlled, especially on windy days As you pass by the rural schoolhouse nowadays, you can see this fresh-air intake with the outside opening projecting downward It is well to have this opening safely covered with a fine wire netting to keep out animals, birds, leaves, or dirt

When the jacketed stove is installed, whether a homemade one or preferably one of the several patented designs now on the market, it is of the utmost importance to see that adequate provision is made for carrying off the smoke and foul air This will require a chimney with a large inside passage, probably about 18 inches square—324 square inches It will be best for this chimney to extend to the floor so that the foul-air outlet can be set flush with the floor in the side of the chimney If the chimney does not extend to the floor, but only a few inches or feet below the ceiling, a galvanized iron pipe about 18 inches in diameter, constituting the vent flue, must tap into the chimney and extend to within about a foot of the floor. The best place for the foul-air duct is within a few feet of the jacket

so that the air will circulate as much as possible through the room before passing out of it Most authorities suggest that, in case a brick chimney is used, a cast-iron or tile stack be placed inside of the chimney to carry off the smoke Cast-iron is better than tile, as the latter is liable to crack and cause trouble This reaches somewhat below the stovepipe hole, and must be tightly closed at the bottom It extends to the top of the chimney The stovepipe connects tightly with this smokestack The chimney should reach well above the roof of the building in order to secure a good draft, and it should be large enough so that the foul air can easily escape around the sides of the smoke flue If the chimney extends to the floor, an ordinary register of adequate size—about 20 inches by 16 inches—must open into it If the galvanized-iron pipe mentioned above is used for the ventilating duct it must have a tightly fitting damper near the floor, and the pipe should be about 18 inches in diameter.

*Courtesy of The Waterman-Waterbury Company*

**Modern square-steel seamless heater**

This is a room-heater and ventilator which looks well and is efficient and durable The walnut enamel finish makes the heater ornamental as well as useful

**Modern cabinet room-heaters.** During the past few years various concerns have produced heaters which are both ornamental and efficient for heating and ventilating purposes Instead of the old round jacket we now find a rectangular cabinet finished in a very presentable school-furniture brown This cabinet jacket with the exterior of walnut-colored vitreous enamel harmonizes with the color scheme of the room and forms a distinctive part of the good general appearance The

enamel coat will not burn, rust, or tarnish. The heater body is made of steel and is very durable The stove and jacket are furnished complete with an insulated fresh-air intake, foul-air register, vent regulator, and smoke pipe It is not difficult to install providing there is a chimney of sufficient size reaching to the floor The foul air is drawn out through the vent register without interfering with the draft.

**Importance of proper installation.** It is of vital importance that the apparatus be properly installed if it is to work well Several plants have been taken out because they would not work Either they were not put in properly at the start, or the teacher failed to operate the system intelligently, the system itself is not usually at fault. It will be the cheapest in the end to have the job done by someone who knows just how to do it. Sometimes the system fails to work well because there are so many air escapes around the doors and windows The building must be repaired if good results are to be secured The commonest cause of trouble is too small a chimney If the chimney is less than 16 inches square, a new one should be built, because the chimney is to carry off both the smoke and the foul air If a suitable jacketed-stove system is properly installed, it will both heat and ventilate the room satisfactorily providing the teacher uses good judgment in operating it

**Why the air circulates.** When the plant is put in as described above, the air will flow in and out of the room as long as there is a fire, if both ducts are open The cause for the flow of air is the difference in the weight of the cold and the warm air—hence the name, gravity system. By heating the foul-air duct with the hot smoke, a condition of unbalance is set up, and so long as this condition continues the air will circulate When the foul-air duct is heated, the air particles are pushed farther apart, a given cubic unit of air becomes lighter, the air rises and makes room for more air to come into the duct. The hot air around the stove inside of the jacket is lighter; the heavier cold air coming in from outside pushes the warm air up Or if both ducts are closed, the air in the room will circulate through

the jacket, the cooler air coming in from below and forcing the warm air up. Both fresh- and foul-air ducts should be kept open while school is in session

It is not correct to say that warm air tends to rise, for the fact is that when some portion of air is warmed, cooler air from the sides and from below pushes the warm air up. Heated air, instead of tending to rise, actually expands in all directions; naturally near the surface of the earth it cannot expand downward very far With a good fire in the stove and the ducts open, a condition of disequilibrium is produced in the air of the room Cold air is heavier than warm air and tends to sink, pushing the warmer air up

No such system will work at all unless the foul-air duct is heated or has a volume of warm and rising air in it. It is important to remember that fact In late spring and early fall the system will not give results because there is no fire and hence no hot smoke to heat the foul-air duct In some large plants the foul-air duct is sometimes heated with a stove placed at the bottom of the flue This, of course, cannot be done in a rural school. The air in a schoolroom is always much warmer near the ceiling than near the floor, but as the air strikes the walls it becomes cooler and sinks This relatively fresh air is breathed by the pupils, becomes contaminated, and being cooler than the air above tends to sink towards the floor and to find its way to the opening in the foul-air duct The system does not work well when the doors and windows are open, but the rural teacher should air her room out thoroughly and often, system or no system

**Can you start a fire?** To start a fire quickly and well you must have dry pine kindling and dry wood cut up fine Insist that your school board furnish these necessary materials. You will be greatly handicapped without them As many young teachers seem quite unable to do a good job of starting a brisk fire quickly, it seems proper to devote some space to the subject: First, clean out all the ashes, be sure the ashpan is empty. Place some paper, torn or twisted or wadded together, upon the

grate Every rural teacher should have a good stack of old newspapers on hand all of the time On the paper place enough dry, fine kindling, and on top of this the dry, fine wood Then place a few of the larger sticks on top of the finer Light your fire from below Now open the damper in the stovepipe and the lower slide check, or even the lower door in the stove. Close the door and the slide damper above the fire If the flues are clean you will soon have a good fire Do not let a wood fire roar up the chimney too strongly Control it so as not to heat the stovepipe too hot, that might be dangerous Add wood or other fuel from time to time as needed, and look at your fire occasionally Some persons prefer not to shake all the ashes out of the grate before making the fire, but you will probably get better results as a rule if you clean off the grate thoroughly This discussion has had reference to a wood fire only If hard coal is used, all that will be necessary each morning is to thoroughly shake the ashes out of the bed of coals, put on fresh coal, and open all drafts In the case of a wood fire, as the wood continues burning and chunks of dry wood are added, a good bed of live coals will be formed During cold weather such a bed of coals should cover the grate during the daytime. Whether wood or coal is burned, the air must have free access up through the grate and burning fuel The stove, the pipe, and the chimney should be kept clean in order that the draft may be good Sometimes failure to keep the room warm is due to the accumulation of ashes and soot. The ashes should never be allowed to pile up, as this may result in warping and permanently damaging the grate If soft coal is used, the wood fire should be well started before coal is put into the stove; otherwise it takes too long to warm the room

**Manipulation of dampers.** The teacher must understand that opening a slide check below the fire always causes a draft and makes the fire burn Opening a slide check above the fire, either in the stove door or in the stovepipe, checks the fire. The fire can also be checked by a damper in the stovepipe Do not confuse damper in the stovepipe with slide check in the

pipe. When the damper handle is parallel to the stovepipe, the damper permits a draft, and when the handle is at right angles to the stovepipe, the draft is checked In the morning when starting the fire of course all the draft possible should be given; it is usually better to open the lower door of the stove to give plenty of draft, being careful, however, to watch and control the fire There should also be a good damper both in the fresh- and foul-air ducts If the chimney extends to the floor, instead of a damper there will be a wing register, which can be adjusted to any desired angle On windy days when the wind comes from the side on which the fresh-air intake enters the building, the damper in this fresh-air pipe should be partly closed

**Value of window ventilation.** No matter whether there is a heating and ventilating system or not, every window in a rural school building should open freely both at top and bottom, and there should be suitable catches so that the windows can be left open for longer or shorter periods and to such an extent as the teacher may determine It needs to be clearly understood, however, that if there is an adequate jacketed-stove arrangement, the system will not operate properly with currents of air coming in and going out of the windows Nevertheless, there is nothing to prevent the windows being opened at noon and at the two recesses while the children are out of doors. They should always be shut in time so that the room is comfortably warm when the children come in to take their seats.

When there is no ventilating system, as is probably the case in a large number of rural schoolhouses, the teacher will need to use the window ventilation a great deal, but every effort must be made to prevent drafts of cold air from blowing directly on the pupils No doubt foul air is deadly enough, but drafts are often dangerous, and teachers must look out for them Every window can easily be fitted with a six-inch pine board, planed and painted; this board should be as long as the width of the window On cold, windy days it will be sufficient to set the board in so that all the space is closed, permitting air to come in between sashes only But on milder days on the windless

side of the building the boards can be set at an angle, thus permitting more air to enter There are now on the market cloth window ventilators, capable of being adjusted to windows of varying width. These are made of fine-mesh, strong cloth and should last a long time They are the means of supplying fresh air without drafts or dust and are useful where a constant circulation of fresh air is needed, which is the case in all rural schoolhouses not provided with a ventilating system These ventilators are not expensive and one for each window would be desirable

It is possible to have a thin board about six inches wide attached to the upper sash in such a way that the current of air will be deflected toward the ceiling when the window is open a few inches, preventing the cold air from dropping upon the children's heads. This strip of board must equal the width of the window in length, it can either be adjusted by means of a cord and a pulley, or it can be fitted with spring hinges so as to operate automatically But no matter whether the teacher has boards both at the top and bottom or not, the room should be thoroughly aired out whenever necessary; this means three or four times during the day In every rural school there should be a window committee to open and close the windows under the teacher's direction

**Need for enough moisture.** In most rural schoolhouses in the cold winter months the air is very dry, the relative humidity getting as low as 25 per cent The relative humidity out of doors on a cold, damp January day may be as high as 85 per cent, but when this air is heated in the schoolroom its volume is so increased that the relative humidity is greatly reduced. Breathing such air is injurious to children A dry air produces dry, cracked tissues of the nose, mouth, and throat; these form lodging places for germs. Such dry mucous surfaces are more liable to disease than tissues which are kept normally moist If no means are taken to introduce moisture into schoolroom air, it becomes as dry as Sahara Connected with every good system at the present time is found a good-sized humidifier,

which should be kept well filled with water all day Several quarts or even gallons should be evaporated on cold days, but too much humidity is also harmful Remember that heating air tends to dry it just as heat dries anything else A committee should keep the humidifier filled in winter weather

**Summary of suggestions and cautions** It will pay any teacher who is responsible for the effective operation of the heating and ventilating plant to read and heed the following.

1. Make a thorough study of the entire system to find out exactly how it works Procure the illustrations, diagrams, and directions from the manufacturing company and then carefully analyze the whole problem

2 Bear in mind that any system, no matter how perfect, requires watchful, intelligent care in operating it from day to day.

3 Be sure that all dampers and check drafts are in good working order

4. See to it that the chimney and the stovepipe are thoroughly cleaned early in the fall

5 Do not allow any accumulation of ashes in the ashpan. Clean out every day Otherwise there will not only be a poor draft, but the grate will be likely to get warped and permanently damaged

6. The gravity system will not work unless there is free and adequate circulation of air. See that fresh air is entering the jacket and foul air leaving the room at all times

7 Have at least one accurate thermometer, two will be better. Do not hang these on the outer walls Suspend them about five or six feet from the floor. Appoint a trustworthy pupil to record the temperature frequently and to keep it not below 65° or above 70°.

8. Appoint one pupil to keep the humidifier filled, especially in cold weather

9 Try to have a full outfit of window board ventilators and also a few of the cloth ventilators Appoint a pupil for each window, to regulate window ventilation

10 See that the room is flushed with fresh air at all intermissions. The pupils should of course put on their coats and wraps and keep them on until the room is warmed again Dead air in a room will not support combustion well

11. Do not consult only your own feelings as to temperature or the need for fresh air. Habitually do what you know is right. Consult the thermometer.

12. Insist upon having a plentiful supply of kindling and small sticks of dry hard wood for starting fires

13 Different tactics are needed for burning wood, soft coal, hard coal, or gas Master the necessary techniques.

14. Don't poke the fire and don't shake the grate too much during the day

15 If you have trouble or difficulties, find out the reasons or the causes, and then act accordingly

## REVIEW, TEST, AND PROBLEM EXERCISES

1. Make a neat diagram of the jacketed-stove system, label the parts, and explain how it works.

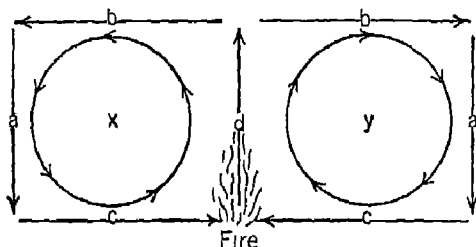
2. Explain exactly why the foul-air duct must be heated. Draw a diagram showing air particles near together and farther apart How is the foul-air duct heated?

3. Draw a diagram showing the necessary arrangement when the chimney does not extend to the ground.

4. Draw a diagram to show the cast-iron stack mentioned in the description of the system Why must it be tightly closed at the bottom? Indicate a place in your diagram for taking out soot

5 State the underlying principles upon which the successful operation of a heating and ventilating system is based

6 Tell exactly how you would have some of your older boys work out the window-board project Compute the cost of fitting good boards into the bottom of six windows

7 What is the cause of the movement of air in a schoolroom? Compare to the circulation of air produced by a bonfire, as shown in this illustration:

**Air currents by an open fire**

8. Make a diagrammatic sketch of a rural school building which has a good basement with a furnace Show the fresh-air intake and the foul-air outlet Indicate the location of registers Show that a furnace is essentially the same as a stove with a jacket See the article in the *World Book Encyclopedia* (1935) on "Heating and Ventilation." Why do we use the term *gravity system?*

## REFERENCES FOR THE TEACHER'S READING AND STUDY

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2. Ayres, M, Williams, J. F, and Wood, T. D—*Healthful Schools*, Houghton Mifflin Company 1918
3. Eells, H L, Moeller, H. C, and Swain, C C—*Rural School Management*, Charles Scribner's Sons 1924
4. Lowth, F J—*The Country Teacher at Work*, The Macmillan Company 1930
5. Salisbury, Albert—*School Management*, Row, Peterson, and Company 1911
6. Wilkinson, W D.—*Rural School Management*, Silver, Burdett and Company 1917.

Teachers and students may write to the National Education Association, Washington, D C, and to the American Medical Association, 535 N. Dearborn St, Chicago, Ill, for instructive information. The Smith System Heating Company and the Waterman-Waterbury Company, both of Minneapolis, will send free descriptive and useful literature.

## CHAPTER VIII

### PLAY SUPERVISED AND UNSUPERVISED

**Significance of play.** An increasing number of thinking persons see in play a wise provision of nature for the development of the human race It does not require much study of the play activities of children to see a close connection between the character and the extent of the child's play and the sort of life he leads when he grows to manhood The playing of the child prepares in an important way for the working of the adult The naturalness, the freedom, the spontaneity of play are vital elements in the development of personality During all the years up to and through the teens, the child needs recreation, play, and the play spirit in his life, if he is to grow into complete and efficient adulthood

An interested, competent teacher can do much to make up for lack of opportunities in the child's home Many country homes are rather dreary places from the child's point of view The interest is largely in work The children do not get much sympathy, play is not given much encouragement. But the spirit of recreation and wholesome amusement is needed in country districts as much as in urban centers Social abilities should be cultivated in all possible ways Here a capable teacher can help the entire community greatly. Boys and girls often leave the farm because country life is so lacking in the means for gratifying their natural, human desires School children desire to play, but often they do not know how to play The teacher needs to teach games as much as she needs to teach anything. At all intermissions children should engage in vigorous play so as to counteract the evil effects of bad postures and of the nervous strain of artificial, routine, and fatiguing school exercises One of the rural teacher's many accomplish-

ments should be the ability to play many games herself. If with this personal skill she is able and willing to direct and supervise her children, she can do much to prepare them for happier living

**Play a basis for education.** Perhaps it would be better to say that the child is educated through play Were it not for the development of mind and body which results from play, the teacher would have little or no basis for her work in the school. When the child enters school at six years of age, through the varied activities of play he has built up his brain and the rest of his body, so that the teacher, utilizing this foundation which nature has furnished, can carry on her teaching processes. Of course physical, mental, and moral development go forward hand-in-hand; we have only to observe children in play to see how their lives are being changed in these three ways each day by their spontaneous reactions to their environment

**Play and health—physical development.** Play develops the heart and lungs, upon the proper growth and development of these organs very much of the success and happiness of the grown man or woman will depend There is probably more danger of underexercise than of overexercise in the play of childhood and youth, although of course both extremes should be avoided If for many years a child fails to secure sufficient out-of-door exercise in the fresh air and sunlight, the chances are that this lack can never be made up, no matter what may be done later.

In this country millions of people are in ill-health all of the time; a good part of this illness may be directly traceable to lack of normal play during the growing years of life. Now that we require children to go to school eight or nine months of the year, it behooves school authorities to see to it that the school environment is wholesome and health-building instead of the opposite. Rural school children need directed play as much as their city cousins, as a means to the symmetrical development of the muscular system. A normal nervous system responsive to the needs of the individual and a vigorous circulation of rich blood are also developed and promoted by proper play.

**Play a moral safeguard.** Innocent play is a moral safeguard because it affords a natural, harmless outlet for that excess of energy and spirit which might otherwise be used in harmful and even dangerous forms of expression Natural play affords a much-needed safety valve for the youth of our land; crime has decreased always uniformly where properly supervised play has been introduced to counteract the evil tendencies of the idle, loafing gang When children and youths can find outside, objective interests and aims to take the place of a morbid subjectivity of mind and spirit, a wholesome moral atmosphere and true moral development are always the results Every careful observer has noted the good effects of well-conducted games and sports Even in state prisons the value of a safety valve in the form of baseball and other games has been recognized and successfully worked out. A rural teacher who knows how to be a good leader can do much to promote the moral health of children through well-planned and well-directed play

**Analysis of moral development.** It will be useful to note some of the moral, social, and intellectual qualities which are developed by play The long list includes the following: self-control, perseverance, obedience, unselfish regard for the other fellow, initiative, leadership, alertness, coolness, warmness, good judgment, and co-operation

*Self-control* This quality is necessary for success in almost any game, as also in the game of life Without self-control but little progress can be expected In playing ball a loss of temper, for example, is fatal Many a baseball pitcher's skill for an entire game has been lost because of a distracting mental upset of some sort, which enough self-control would have prevented

*Good judgment.* The best players are, other things being equal, those who use the best judgment Judgment is an intellectual quality, but it contains a moral element Judgment is needed in all situations in life. It is slowly built up as a result of working and playing in many situations demanding a variety of interpretations and reactions To be a player or a citizen of good

judgment is to merit and to receive the praise of the group or of the community.

*Obedience.* The spirit of true obedience and the readiness to obey are essential qualities of the most effective citizenship. Such obedience is learned on the playground, particularly if the play is properly supervised. The child understands that he cannot expect a place in the game unless he conforms to the rules and obeys the leader or captain. As he does not wish to lose his place, he obeys, even though he may be disobedient elsewhere, for a time, until he sees the fundamental need for obedience in all the relations of life.

*Co-operation.* Teamwork is needed in modern civilization; it is needed among country people, who often find such co-operation difficult because they were not trained to it in childhood and youth. Group games cannot succeed without the spirit and the method of co-operative endeavor. Children need to learn to subordinate selfish personal interests to the good of the social body. Such training in unselfish co-operation makes for the highest and best type of citizenship—a type greatly to be desired in our day and age.

*Initiative.* This means both the ability to start and the habit of starting new undertakings or enterprises and of carrying them on to successful termination without being told or controlled by any outside force or authority. Country boys and girls are often lacking in initiative because they have been too much under the artificial domination of parent or teacher. They need the opportunity of the playground for initiative and freedom in individual activity. Play assists greatly in placing a child upon his own responsibility, where he must choose for himself his goal or purpose and the means of accomplishing or realizing it.

*Unselfishness.* Play affords plenty of opportunity for children to think of one another, especially of those who are weak and cannot do everything which a normal child can do. In every school there are children who for one reason or another are "picked on" and mistreated in various ways. It is the teacher's

business to see that bullying is discontinued and that the bully gets what is rightly coming to him—righteous retribution The teacher needs to know what is going on outside, it is very unwise to permit injustice to continue day after day It is training in bad citizenship The wrongs of the playground may well serve as objective material for practical civics One of the lessons of government should be that the strong shall protect, rather than exploit or abuse, the weak

*Alertness.* Success in life demands alertness, quickness, promptness of response, the ability to decide and to act quickly; games teach and train children in this quality, for the game itself is impossible without nimbleness of wit The slow thinkers are pushed aside, left behind, or defeated because of their slowness A normal child soon learns the lesson that he must "speed up" if he is to hold his own So he frees and quickens his mental and physical machinery, and develops needful skill in running, dodging, or in throwing the ball This alertness is carried over into the work of the school, the better moral fiber, along with the development of intellectual acumen, results in greater progress in school work

**The teacher's part in play.** The character and the extent of the play in a rural school will be determined by the aims, the standards, and the spirit of the teacher That the teacher has responsibility in the matter of play as well as in the teaching of geography, for example, becomes apparent as soon as the place and the function of play in education are understood. When the teacher understands that play is not only recreative but also educative and that the advancement of her pupils is in large degree dependent upon the kind and the amount of playing they do, play will occupy a larger place in her plans and programs. As a matter of fact, play in the best schools is a regular part of the curriculum and receives daily attention with the other educative procedures

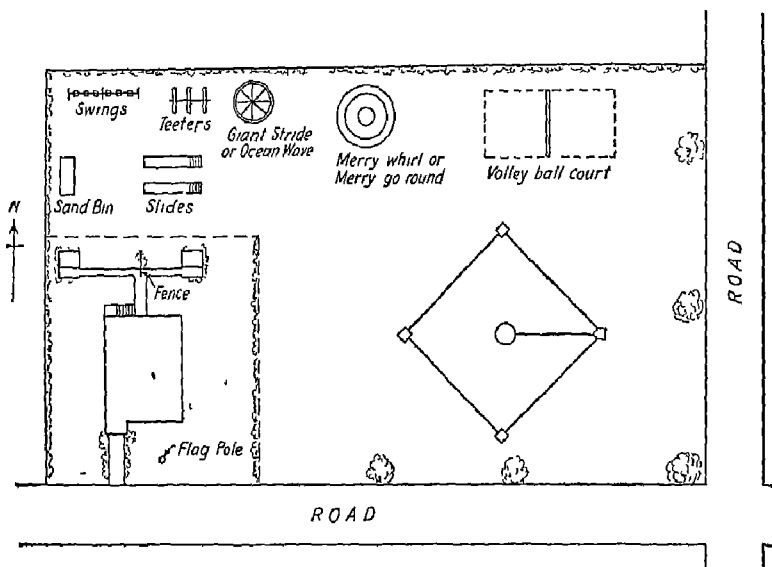
The rural teacher should know how to play the ordinary games, she should go out on to the playground with the children at noon and recesses during at least a portion of such periods

every day. By taking part in the play of her pupils the teacher will be using the ounce of prevention in matters of management, for frequently there is no small amount of mischief and evil which may go on at intermissions

**Supervised play.** Supervision does not mean interfering with the rights of the children. It does not mean thwarting them in their natural, spontaneous activities It does not mean making their play any less enjoyable The right sort of supervision is not meddlesome, rather it allows for the free expression of the child's play spirit. Supervision is the unostentatious, kindly directing of playground activities into channels which are most worth while because purposeful, better co-ordinated, and better calculated to produce true educational results Supervision is unquestionably needed, when children are left wholly to themselves, they do not vary their play greatly and they are quite likely to engage in play which involves very little if any educational value. One of the very best results of the teacher's presence on the playground and of her active participation in the games is the salutary effect upon the pupils and thus upon the school Thus the teacher protects herself and promotes her own welfare In several states the rural teacher is expected to spend a portion of the noon hour in supervision of the playground. By exercising wise control she prevents disorder, secures fair play, and furthers honest and honorable co-operation, all of which are important in developing the good citizen.

**Group games.** It should be the teacher's constant aim and effort to have as many children play as possible. There should be the maximum number of active participants and the minimum number of passive spectators In order to bring this about the teacher must see to it that the good and the poor players are mixed A good plan is to appoint two leaders who will choose the members of their respective groups Then these groups may contend against each other for the day or the week, as desired For example, in the broad jump the total number of feet jumped by one group will be compared with the total of the other group; if each side has both good and poor jumpers the contest will be

fair and interesting This plan of playing group against group can be used in several kinds of games and sports

**The playground.** Many, probably most, rural school grounds are entirely inadequate both as to size and the nature of the plot of ground on which the house stands It is quite common to find a school yard of less than an acre; it often seems that the

*Courtesy of State Department of Public Instruction, Madison, Wis*

**Revised plan for adequate school grounds**

54 yards by 90 yards—approximately one acre

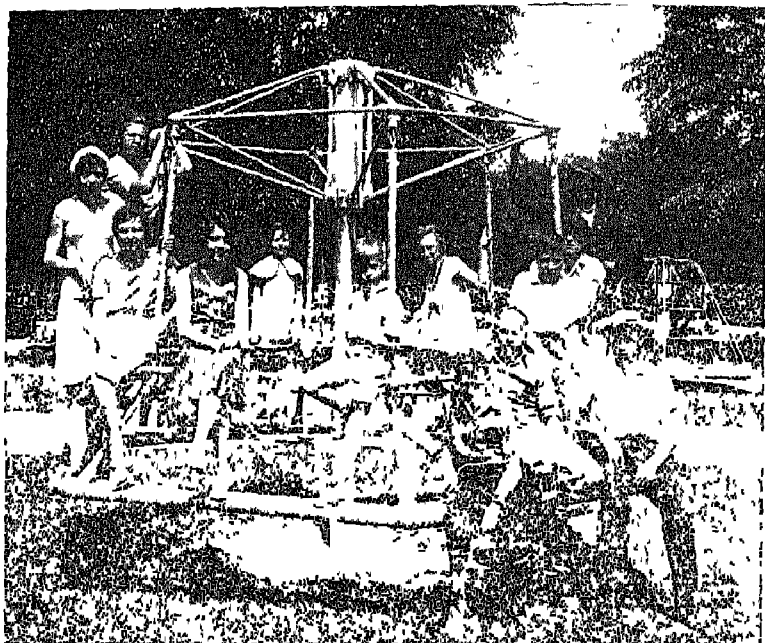
poorest land in the district had been selected for the site The school lot is often small, rough, and altogether unfitted for a playground It may be nothing more than a gullied, uneven, stony hillside, good for nothing except possibly a sheep pasture There is no place to play the ordinary games, and as for a baseball diamond, that is entirely out of the question Purely mercenary motives must have governed the selection of the site Fortunately, there are numerous exceptions to the above rather dark picture The site should be not less than two acres in extent, so that there will be ample space for a baseball diamond

and room on the sides for other games The building should be set far enough to the front of the grounds, so that, while allowing for a good lawn on the side toward the road, there will also be plenty of room in the rear for the playground. The surface should be even and free from stones It will not be a difficult task for the children to clear off all the smaller stones and pieces of wood If the school board and other taxpayers of the district look after the heavy work, surely the teacher and the children with rakes and hoes can take care of the job of keeping the grounds clean This is a legitimate way in which to use some school time

There should be no trees to obstruct the play. A tree for a base in playing ball is hardly the proper thing The suitable place for trees is along the sides or perhaps for ornamental purposes on the lawn in front, surely not on the playground itself. There should be a well-rooted sod, thick and capable of withstanding the wear and tear which the children will give it

If the grounds are fenced, there should be some easy way of getting through the fence in the rear, perhaps by means of a stile, so that a ball can be quickly recovered without danger to the child or to the fence No walks should run directly across the playground, at least not diagonally across, the walks to the outbuildings can just as well run along the side or rear fence. The play space should be as unobstructed as possible Seesaws, volleyball posts, swings, giant strides, or turning bars should not be placed in the middle of the grounds, but quite near to and running parallel to the fences

**Playground apparatus.** (*a*) *Conditions and needs* It is much more common now than a decade ago to find various pieces of apparatus for play on rural school grounds. It is not unusual at the present time to see swings, seesaws, giant strides, children are now playing volleyball and tetherball in many schools, as well as baseball, the old standby. There are still too many schools with little or no equipment, but great gains have been made in the past twenty years Sometimes poor judgment has been shown in the selection of apparatus. A cheap quality has

often been purchased, this has caused more or less trouble, in some cases actually endangering the lives of the children Many schools have homemade apparatus, some of it strong, well-

*Courtesy of the Ever Wear Mfg Co, Springfield, O*

**The merry-whirl for everyone**

A well-built, safe merry-whirl is a good investment

made, and attractive in appearance, but a good deal of it is not built right and is more or less unsightly "Every school should have some equipment, but the teacher must not feel that her responsibility is lessened, for there is no virtue in the apparatus itself It is only one means to an end Swings and teeters will not create in a child a spirit of fair play or teamwork, perhaps not even the play spirit The apparatus should supplement, not take the place of, organized play" Nevertheless, it remains true that while children can play many games with little or no equipment, the swing, the slide, the giant stride, and the sand-

bin will add greatly to the play situation and assist the rural teacher to solve the play problem, especially with the smaller pupils

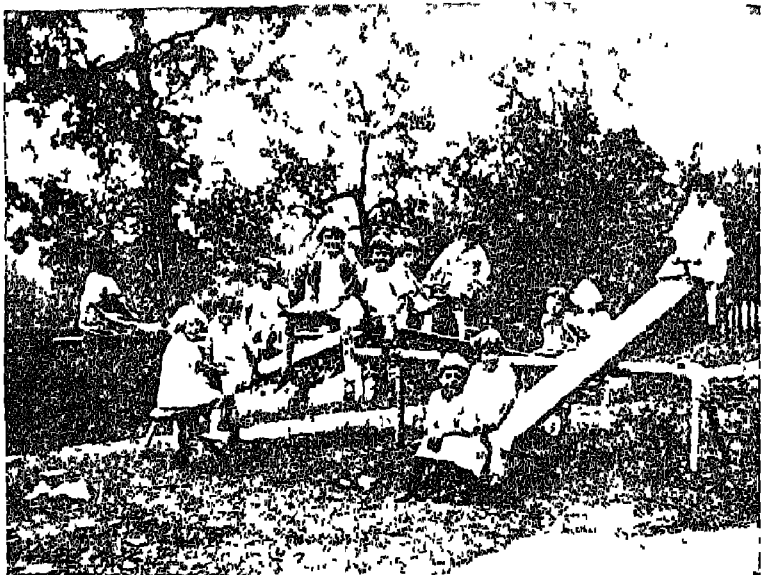
(b) *Elements which determine selection* When the question of what to buy or make in the way of apparatus is up for consideration, the number of pupils, the ages and sizes of pupils, and the probable use of the equipment should be given due weight. It is a fact that in many rural schools most of the pupils are in the first four grades; they are primary children and will not be able to play basketball, for example As K C. Richmond suggests in his bulletin, basketball was at one time all the go and school grounds were fitted out with the posts and baskets, which were used but little or not at all because there were no children old enough to use them Swings and seesaws will be used by small children, but not basketball or tennis courts In the selection of apparatus it usually will pay to get a first-class quality of material, if not, indeed, the very best It will be a good investment to get a first-class playground ball, covered with horsehide. It is unsafe to buy a cheap slide or a cheap giant stride Some homemade giant strides are no doubt safe, and some are a menace to the lives of the children

(c) *What to get.* Richmond in his bulletin on Rural School Playgrounds and equipment,[1] writes as follows:

"The following equipment for the average one-room country school is suggested two playground baseball bats; one pair of jumping standards, one sand pile; two seesaws; two swings, one turning bar; one volleyball, net, and posts; six beanbags for indoor use, one *Games for the Playground, Home, School, and Gymnasium*, by Jessie H Bancroft, published by The Macmillan Company

"The preceding list includes the essential minimum equipment and apparatus that should be placed in every school though other equipment might be added A larger selection might well include these additional articles. One giant stride,

[1] Richmond, K Cecil—*Rural School Playgrounds and Equipment*, Bureau of Education, Washington, D C

one slide, one tetherball post, six tetherballs, four tennis rackets, one tennis court with net and posts, one pair flying rings, one trapeze, one soccer football"

*Courtesy of the Ever Wear Mfg Co, Springfield, O*

**Smaller pupils always like the seesaws**

The equipment which any school possesses will depend upon the ideas and ideals of the teacher, her energy and leadership, and the public, progressive spirit of the taxpayers and the board The average district can have and will have what it needs and *wants very much*

(*d*) *Sandbin or sand pile* This is one of the easiest things to provide and one of the best, especially for the smaller children A sand table inside and a sandbin outside should be considered essentials This bin should be about eight by twelve feet, built with ten-inch planks and with a ten-inch board around the sides for table and seats No doubt the lumber and sand could be furnished by people in the district. This sandbin may best be placed under a tree in a corner of the grounds out of the way.

It will be used a great deal during the fall and spring months, for children like to dig and form various designs in the sand. By all means, have a sandbin It is simple, cheap, serviceable.

(e) *Swings* Two good swings should be provided, they should be very strongly built and set to swing parallel with the fence No chances should be taken on weak construction If

*Courtesy of the Ever Wear Mfg. Co, Springfield, O.*

**A combination equipment**

There are several other combined arrangements

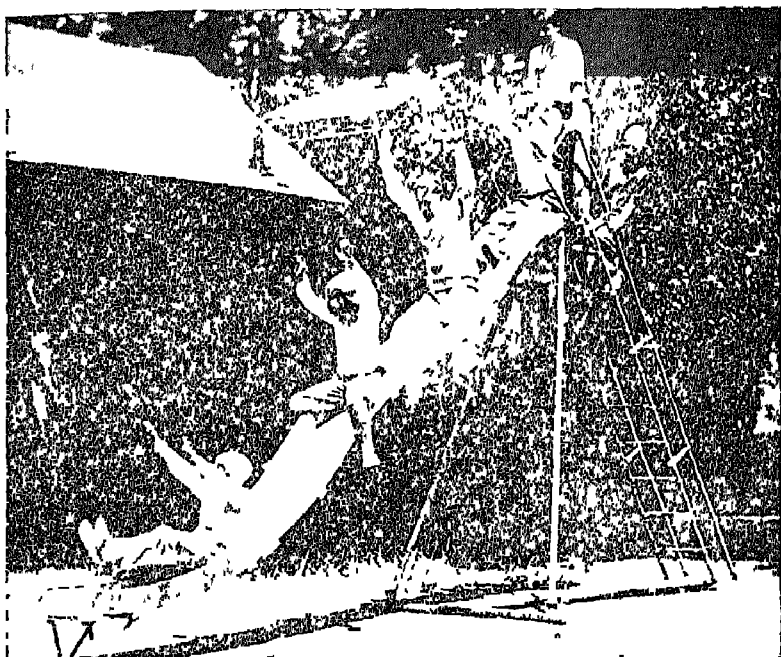
wood and rope are used they should be inspected frequently to see that they are in good condition The swings will be used a great deal by the smaller children and sometimes by the older ones The teacher should instruct the children in the use of the swing, and caution them not to stand up or get in the way when the swing is moving The seat boards should be ten inches wide and about two feet long The rope should be of such length that the boards come about two feet above the ground The

best way to attach the seat board is by means of holes through the board for the two ropes, one on each end. Examine the ropes frequently to detect flaws.

(*f*) *The giant stride* The giant stride is one of the safest and most useful of all playground equipments, providing it is properly and strongly built It can be homemade; or if funds are available, a first-class piece of apparatus can be purchased at a reasonable figure Buy one with ball bearings The essentials for a giant stride are a pole, a wheel, and enough inch rope. A hickory pole about sixteen feet long and eight inches in diameter will answer the purpose A discarded wagon or machine wheel should be used, if it is strong and able to stand the strain This wheel should be mounted on top of the pole so as to rotate freely. The pole ought to be set solid four feet or more in the ground—better, in concrete Six ropes may be securely fastened to the wheel and should come down not far from the ground with loops or knots as far up as the children can reach. Rope ladders are better The giant stride is a very good substitute for the merry-go-round. Children delight in swinging out and around, sometimes jumping, sometimes off their feet. This is good exercise for children of various ages.

(*g*) *Jumping outfit* Children like both the long jump and the high jump For the long jump a pit is needed, for the high jump standards are necessary to avoid guessing. Both the pit and the standards can be made by older boys under the teacher's direction For the pit, the earth needs to be dug out for about fifteen feet, and six or eight inches of sand or sawdust placed in the bottom This makes a soft landing surface. It is well to provide a jump or "take-off" board also A pair of standards consists of uprights firmly fastened to broad bases. The uprights need holes an inch apart in which to place pegs for supporting the string or crosspiece The two uprights should also be marked off in feet. The pit and the standards will afford the means for unlimited play and exercise.

(*h*) *Coaster slide* Slides can be purchased at prices ranging all the way from fifty or sixty dollars to twice as much Children

use the slide very much and enjoy it The wear on the clothing is not so great as some people think The slide should be well built with nonrust steel bottoms, hand rails, and all other parts well constructed Several children will use one slide,

*Courtesy of the Ever Wear Mfg Co , Springfield, O*

**Children enjoy this wave slide It is portable**

going down one after the other with little commotion, or quarreling The slide is not so dangerous as the swing or the seesaw. A good slide is a good investment. Get a thoroughly good slide or don't buy any at all

Any rural teacher can procure illustrations and prices from school supply houses and manufacturers See also the references at the end of this chapter The best equipment is now built in accordance with the recommendations of the committee on standard specifications for the construction of playground

apparatus, appointed by the National Recreation Association, New York City

**How to get equipment.** In some districts money to buy playground equipment will be set aside in the annual levy at the school meeting If the taxpayers and the board see the value of play and the need for equipment, the problem is simple enough It may be, however, that the teacher will need judiciously to educate the people of the district up to the point where the funds will be forthcoming She can often do this through the children, or by means of a mother's meeting where she can courteously and wisely present the facts and the arguments In some districts it will be possible to have some of the apparatus made by the older boys or by the men of the district If sufficient interest is created, a great deal of assistance will be rendered in this way Such interest may sometimes grow out of an evening school entertainment and community "get-together." At such a time some good speaker may present the cause of play so convincingly and appealingly that interest and co-operation will be secured The proceeds of a box social, or some similar function, may be used to buy equipment The author has known rural teachers to take in as high as $75 00 in one evening In some cases teachers have secured funds by having pupils make and sell various articles at a school fair or bazaar How far shall we go in buying school equipment with entertainment, box-social, or pie-supper money? What is the distinction between luxuries and necessities? What was once considered a luxury may now be a necessity. Playground equipment should be classed with school essentials

**Ball games.** Nearly all children like to play ball There is a general perennial interest in ball games. Every rural school should have enough good balls and bats to supply the needs of the pupils

(a) *Playground baseball.* Although baseball is our national game, it is hardly possible to play the regulation game in a rural school because it will usually be impossible to make up the two nines The attendance is relatively too small, the pupils

are of all ages from five up to fifteen. However, with the larger and softer playground ball it is entirely possible to play a game with fewer players on a side. Very often some of the older girls become excellent players, even excelling some of the boys. In most schools all but the primary children can play the game The pitcher tosses the ball; as it is soft, the children do not fear it. No gloves are needed Since the ball is large and is tossed and not thrown swiftly, it is easier to hit; thus more runs are made, adding much to the pleasure and the exercise This game gives a chance for organized, co-operative play, which is better social training A soft 14-inch or 16-inch ball with a strong well-sewed horsehide cover is used The bases are sacks of sand.

(b) *One old cat* This is a fine game for girls as well as boys A soft playground ball is used Four or more can play at the game The players comprise the pitcher, the catcher, the batter, and as many fielders as desired or available The batters do not run bases When the pupils come out on the playground at intermission, one cries out "my first bat," and is the first batter. In the same way others become catcher, pitcher, first fielder, second fielder, and thus down the line In playing, if a fly ball is caught, if the ball is caught on the third strike, or if a foul ball is caught on the fly, or on the first bound, then the batter is out If a third strike is not caught, then the batter is given three more strikes When a striker is out, the catcher becomes batter, the pitcher becomes catcher, the first fielder becomes pitcher, and so on The batter who goes out becomes the last fielder Sometimes the game is varied by having the batter run to a base and back to home plate when he strikes a fair ball In making this run, the batter is out if the pitcher or catcher or some other player reaches the home plate with the ball before he does. One old cat is lots of fun, and children rarely tire of it.

Teacher and children can easily learn to play other ball games, such as volleyball and dodge ball by studying the directions in a good manual or by learning from someone who knows the games.

**Township and county playdays.**[1] The county playday, first held in the fall but later in June each year, is the finale of preliminary township playdays held in May The county playday is held at the county-seat fair grounds and is attended by several thousand persons.

Township playdays afford opportunity for competition involving both children and adults in athletic events and in other contests The school-district team that wins first honors in a given event at the township playday represents its township in the intertownship competition at the county playday

Of 135 one- and two-room school districts in 18 townships that held playdays the first year at least 120 participated, while 69 different districts won first honors in one or more events. There are 150 such districts in this county of 20 townships

At the township playdays pennants displaying the township colors are provided by the local playday organizations as awards to the districts that score the largest number of points in the day's events Honor ribbons are awarded to individual members of teams that score first, second, and third places in each event. The offering of prizes by merchants or other commercial concerns is discouraged, as it is felt that the playdays should be sponsored mainly by the people of the school districts and that the prize-winning element should be kept in the background. The principal deviation from this rule in one case was in connection with the kite tournaments, for which prizes were furnished by a daily newspaper This newspaper, which sponsored a good times club with branches in all of the rural schools of the county, originated the kite-contest plans, and furnished directions for kite making to the schools

The central idea of the county playdays is to get everybody to do some playing For this reason events for school pupils and those for adults are carried out simultaneously, while a committee entertains the children under school age with circle games or storytelling While adults are using one kind of equipment, school pupils are using a different kind. When

[1] This section was originally prepared by Florence Slown Hyde.

any equipment is not in use for a scheduled event, it is available for impromptu games that any group wish to engage in

Not to exceed an hour is allotted for a musical and literary program by school pupils or other talent, immediately following the dinner A few townships raise money to hire a band, but those that do not go to this expense seem to have more zest for the playday games and contests It is found that a refreshment stand in charge of a volunteer committee nets enough profit to pay for pennants and individual badges and to meet other small expenses In one case the stand operated at the county playday returned a profit of $85 00 the first year, which, with a $3 00 assessment on each township, provided a fund sufficient to pay all expenses In each succeeding year expenses have been met with little difficulty County playday trophies were wooden shields finished in mahogany with silver lettering designating the honors won and the names of team members These shields were awarded to twenty-two different districts

The competitive events are largely planned with the idea of team play, thus giving the little fellow a chance to do his bit to help his school win Small schools are encouraged to compete with larger schools through a system of dividing the points scored by the school enrollment Two age groups are found sufficient for the relay races and jumping relay, the dividing age being eleven years In the boys' jumping relay the total jumps of all the boys are added, which gives the short jump of the little fellow a chance to help his team win In the girls' baseball throw, the distance of each girl's throw is added to the score of her side, and the total determines the winning team

The basket dinner is usually planned by a committee composed of one woman from each district; it is served cafeteria style The most expeditious arrangement is a hollow square made with tables or planks and having the complete menu assembled on each of the four sides, thus making it possible to serve four lines of hungry folks at the same time

*The athletic events* The program of athletic events and other contests carried out at one county playday, including the prescribed size of teams participating, was as follows.

FORENOON

*A. School Pupils' Events*

Playground Ball Tournament—
9 to 11 (5 to 10 boys and girls)
Boys' Horse Shoe Tournament—
11 to 12 (2 boys)

Kite Tournament—
(One boy or girl who won first honors in kite flying in each age division at township playday)

*B Adult Events*

Men's Volleyball—9 to 10 30
(4 to 6 men)
Women's Corner Ball—9 to 10 30
(6 women)

Men's Horse Shoe Tournament
10 30 to 12 30 (2 men)
Women's Potato Relay Race—
(4 women)

Dinner served 12.00 to 1 00

Community Singing and Short Address 1 00 to 1 30

AFTERNOON

*A. School Pupils' Events*

Volleyball—1 30 to 3 00
(4 to 5 boys or girls)
Jumping Relay—3 00 to 3 30
(4 boys with girls making up the quota if necessary)

Girls' Baseball Throw (4 girls)
25-yard Relay—3 30 to 4 00
50-yard Relay—3 30 to 4 00
(4 boys or girls)
Boys' Centipede Race—4 00 to 4.15 (4 boys)

*B. Adult Events*

Men's Kitten Ball—1 30 to 3 30
(5 to 10 men)
Women's Playground Ball—
1.30 to 3 30 (5 to 10 women)

Men's Sack Relay—3 30 to 4 00
(4 men)
Women's Nail Driving—
(1 woman at a time)

**How playdays were organized in the foregoing case.** The committee for township playdays drew representatives from each district for committees on grounds, games, dinner, program,

stand, and reception or invitations The games committee had a subchairman in charge of each event

The work of organization was done under the direction of a county Y. M C A secretary, who started the township play-days as a form of community service Equipment for all events was furnished by the Y M C A, with the secretary at hand to assist in carrying through the day's program.

Township and county playdays have now been carried out in one county each year for many years. The attendance is always large and the interest continues unabated It would seem that these annual events are now a permanent part of the life of the county, greatly to the physical, social, and civic welfare of children, young people, and adults

**Standards of a Good Sport at All Times**[1]

| HE | HE |
|---|---|
| 1. Plays fair at all times. | Does not cheat |
| 2. Plays hard to the end. | Does not quit Is not "yellow" |
| 3. Keeps his head | Does not lose his temper, even though wronged |
| 4 Plays for the joy of playing and for his team's success | Does not play for money or other reward |
| 5. Is a good team worker. | Does not "play to the grand-stand" |
| 6 Keeps training rules. | Does not abuse his body |
| 7. Obeys orders of coach or captain | Does not shirk. |
| 8. Does his best in all school work | Does not neglect his studies. |
| 9. Backs his team in every honest way, but— | Does not bet Does not think betting necessary to show loyalty. |
| 10. Gives his opponent a square deal. | Does not take any technical advantage Treats visiting players as guests. |
| 11. Is respectful to officials. Accepts adverse decisions graciously Expects the officials to enforce the rules | Never blames officials for defeat. Does not "crab." Does not "kick." Does not complain. |

[1] Source of these standards not known to author.

WHEN HE LOSES

| | |
|---|---|
| 12. Congratulates the winner Gives his opponent full credit Learns to correct his faults through his failures | Does not show his disappointment Is not a "sorehead" Does not "alibi." Does not make excuses. |

WHEN HE WINS

| | |
|---|---|
| 13 Is generous Is modest. Is considerate | Does not boast Does not "crow." Does not "rub it in" |

AT ALL TIMES

| | |
|---|---|
| 14. Is true to his highest ideals. | Does nothing unworthy of a gentleman and a 100 per cent American. |

## REVIEW, TEST, AND PROBLEM EXERCISES

1. Write out cautions which you think should be observed by teacher and pupils in regard to play, including the use of playground apparatus

2. Get a catalogue and compute the cost of equipping a country school playground with all that is necessary for a school of twenty pupils of ages from six to twelve.

3 On pages 136–138 seven personal attributes or qualities are discussed briefly. Add three more to the list and arrange all in the order of their importance.

4 Write ten rules and directions for the care of playground apparatus.

5 Tell fully how to make a homemade giant stride that will be safe and workable.

6. You are to have a mothers' meeting on the fourth Friday afternoon in September Outline a brief talk in which you will endeavor to secure the co-operation of the mothers in purchasing some playground equipment.

## REFERENCES FOR THE TEACHER'S READING AND STUDY

1. ACKER, ETHEL F.—*Four Hundred Games for School, Home, and Playground,* F. A Owen Publishing Company. 1923.
2. BANCROFT, JESSIE H.—*Games for the Playground, School, Home, and Gymnasium,* The Macmillan Company. 1909.

3 ELMORE, EMILY W —*A Practical Handbook of Games,* The Macmillan Company 1922

The following publications may be procured by application to the Superintendent of Documents, Washington, D C. The best way for a teacher to do is to buy a set of 20 coupons for one dollar These are good at any time and are convenient for paying small amounts

1. *Brief manual of games for organized play.* Revised 1925 37 pages, illus (Children's Bureau Publication 113 ) 10¢

2. *Games and equipment for small rural schools* 1927. 16 pages, illus (Physical Education Series 8) 5¢

3 *Organized recess* 1930 (Education Pamphlet 2 ) 5¢.

4 *Rural-school playgrounds and equipment.* 1920. 12 pages (Teacher's Leaflet 11 ) 5¢.

5 *School grounds and play.* 31 pages. (Education Bulletin 45, 1921 ) 5¢

6. *School playgrounds* 1930 40 pages (Education Pamphlet 10 ) 5¢

Send to the Superintendent of Documents for price-list No 31, Education It is free

The following organizations will send interesting and useful descriptive lists to teachers who ask for them

1 American Junior Red Cross, Washington, D C.

2 Boy Scouts of America, 2 Park Ave , New York City

3. Camp Fire Girls, 41 Union Square, New York City.

4 Girl Reserves, National Board of Y. W. C A , 600 Lexington Ave., New York City

5 Girl Scouts of America, 570 Lexington Ave , New York City.

6 National Child Welfare Association, 70 Fifth Avenue, New York City

7 United States Department of Labor, Children's Bureau, Washington, D C

8. United States Treasury Department, Public Health Service, Washington, D. C

9 Young Men's Christian Association, New York City

10 Young Women's Christian Association; Association Press, New York City.

# CHAPTER IX

## CURRICULUM, CLASSIFICATION, AND CLASS PROGRAMS

This chapter brings together certain related ideas pertaining to courses, classes, and the daily program largely from the teacher-management point of view State and county authorities determine, for the most part, the rural teacher's standards and practices in the entire field of subject matter, that is, of the content, organization, and schedule of classes. But even with the best course of study and the most ideal program the effectiveness of the teaching-learning processes rests wholly with the individual teacher "As is the teacher, so is the school" will always be true

### THE RURAL-SCHOOL CURRICULUM

**Limitations of the one-teacher school.** Any person who understands average rural-school conditions will not expect to find in such a school as rich and as varied educational opportunities as are found in more favored places Of course the curriculum is vastly more than an outline of subjects and of subject matter A real curriculum, from the modern standpoint, is a program of life-giving child activities and experiences The central idea should be social participation in a wide range of carefully selected pupil activities, purposeful in character and calculated to develop the child in all the aspects of his social nature. With children in all of the eight grades, with often an immature and untrained teacher, and with the social limitations of the environment, let us not look for too great educational results from the rural schools If we do, we shall surely be disappointed.

**Educational objectives and the rural-school curriculum.** Undoubtedly the objectives as outlined by the reorganization com-

mission in 1918 are still recognized as of basic value in curriculum construction Any course for elementary or secondary schools will always need to consider (1) health, (2) command of fundamental processes, (3) worthy home membership, (4) vocation, (5) citizenship, (6) worthy use of leisure, (7) ethical character. Any curriculum to be most useful must embody these objectives Provision must be made for the development of the necessary and appropriate ideas, ideals, and habits All the fundamental skills are vital, but so are tastes, appreciations, and the like. The three R's are of course important, pupils need to be well grounded in the ordinary, basic skills. The head, the hand, the heart, and health all demand attention These are the four H's The implication in the four H's is that all of the child's being is to be influenced by the educative process The rural child needs to be prepared to meet the "practical and the cultural demands of modern life" The rural-school curriculum should utilize the resources of the rural environment but it should be as broad, as rich, as suggestive, as enlarging as possible

**Content of the course of study.** When the writer began teaching in a rural school the course-of-study manual comprised less than fifty pages As he writes this there lies before him a course issued by one state of over one thousand pages of very fine type. This course would make at least four books the size of the present volume. There are very detailed outlines in the time-honored subjects and further excellent material on health and character education, programs, social studies, music and music appreciation, picture appreciation, manual training, home making, and 4-H club work This manual is for rural and graded elementary schools If rural teachers could make real such a content of subject matter in the lives of rural boys and girls it would be a revolutionary achievement What is the attitude of the average rural teacher toward such a vast array of admittedly high-grade material? What is her success in a one-teacher school in carrying out these valuable suggestions? Such a course-of-study manual should be used in training institutions for the most careful analysis and discussion in class exercises Such a

wealth of material should be made so practically available for rural teachers that they will actually make use of it day by day. Such excellent curriculum manuals require constant study by all teachers who use them.

**Wide variation in different states.** No two states have exactly the same course of study. If the various manuals are examined, considerable diversity in both content and arrangement is found. Conditions vary in different sections of the country, no doubt the school offerings should also differ However, a broad, general field of basic educational material should be found in all parts of the country States are left pretty much to themselves in determining curricula and no doubt rightly so Education is largely the business of the states It is certainly a problem, however, of great national concern It is entirely possible to formulate objectives and principles in curriculum construction which will be universally applicable A certain body of subject matter, of pupil activities, and of suggestions for personality development should be found in all courses, even though there are many variations in the several state curricula

**The curriculum and our modern world.** Civilization today has become such a complex affair that the schools must change their organization, courses, and procedures so as to prepare our children and youth for participation in a social organism quite different from that of a generation ago Not only must there be training for practical affairs, but the individual must also learn to make such social adjustments as will enable him to secure the maximum of personal enjoyment and satisfaction in living We find ourselves in an age of rapid transportation, of remarkable ease of communication, of the motion pictures and the radio, of the far-reaching influence of the modern press, of tremendous developments in all the sciences and arts, of new and greatly improved means for the prevention and cure of disease, and of many other evidences of invention and progress The curriculum must acquaint the child with the world in which he lives, and it must help him to find his place where he can make both a living and a life

**What is a balanced curriculum?** The old curriculum is now barren, formal, dead The new curriculum provides for all phases of our social life The child learns to do a great many things He acquires those skills and abilities which are needed for adaption to the social and economic requirements of the day. In a balanced curriculum we find a place for the so-called bread-and-butter subjects, but we also provide music, art, social sciences, the practical arts, and all else that is true and vital preparation for life today Old-time school materials are now subjected to the scrutiny of scientific educational research; the useless elements, which have no bearing today on the needs of successful living, are stripped away Essential knowledge, activities, and experiences are utilized so as to produce a balanced personal development of the child A balanced curriculum is one that reaches out into life as it actually is and reflects and utilizes the best in science, literature, language arts, social studies, natural sciences, fine and industrial arts The balanced curriculum ministers to the whole child—body, soul, and mind—with all his needs and in all his human relationships We do not find any such richness of child experiences in the average rural school So the average rural child is decidedly handicapped in his competition with children and young people who have had the advantages of a well-rounded and well-administered curriculum

**Curriculum construction a continuing process.** The curriculum is never finished It is always in process of becoming. As social conditions and needs change, the curriculum must change In every state and county there should be permanent committees keeping in touch with the latest developments In the field of rural education actual accomplishments are always far behind possible achievements The curriculum for rural schools can be much improved; so, too, can the educational procedures and the administrative machinery for making real such courses as we now have Supervisors and teachers should become more generally interested in the principles and objectives of curriculum construction. In institutes and educational meetings gen-

erally teachers should receive very definite instruction in the meaning and educational implications of what they are expected to teach Our civilization is changing, our schools must change if they are to meet the new requirements of a changing world. It is indeed unfortunate that so many rural schools are still making use of an outworn scheme of studies when we find on all hands such tremendous evidences of inventive achievement and progress In courses for rural teachers there should be a place for a careful study of the whole science and art of curriculum making. Moreover, the young student should definitely come to realize that few things in this world are settled and adjusted permanently This is particularly true in the field of education

### Classification and Classes

**Classification procedures.** 1 By the end of the second week of school the teacher should know the relative classification of each child One's predecessor should have left a record, but if she has not, get the facts from pupils and parents. During the first week or two the teacher should make use of homemade inventory tests to discover the knowledge and abilities of her pupils in the various subjects, but she should be very careful not to put pupils back unless it is absolutely necessary Tabulate the classification of your entire school on a large sheet of Manila tagboard, so that you can refer to it readily.

2. Classification is the teacher's prerogative and duty She must settle the matter herself and not permit parents to do so. Often in classifying pupils satisfactorily, compromises can be effected The teacher must consider the best interests of each child in the light of several controlling elements.

3. A country school cannot be classified like a graded school. Failure to see that grades are to be grouped together (7 and 8, 5 and 6, 3 and 4) in reading, arithmetic, and other subjects is the source of many a teacher's difficulty At the present time there should be no rural school in this country where such grouping is not practiced.

4 In order properly and promptly to classify her school a teacher must know: (*a*) the subject matter to be taught, including an outline of the course of study; (*b*) the abilities of the pupils, determined by modern methods of testing, (*c*) the advancement of each pupil, his present place in the grades in each subject Mary may be in the sixth grade in reading but in the fourth grade in arithmetic

5. Start with reading In a school comprising all grades, have six reading classes. A (7 and 8), B (5 and 6), C (3 and 4), D (2), E (1), F (beginners) Beginners should not be permitted to start in the spring Four language and four arithmetic classes, besides the beginners, will be sufficient, as follows: A (7 and 8), B (5 and 6), C (3 and 4), D (1 and 2)

6 Usually you will have only two formal spelling classes, one for the seventh and eighth grades, and one for the fifth and sixth grades The rest of the pupils will spell in connection with the work in reading.

7 Combine gradually. Show the school that good work determines promotion Review and test often. Don't allow a child to keep on trying to do work beyond his depth. Instead of putting a child or a class back, proper reviews and the necessary teaching may be utilized until the work is up to grade. Demotion is serious business and is usually unnecessary.

8. In determining a pupil's classification in school some present-day authorities advocate the regular use of general intelligence tests, in some city systems such tests are used extensively.

It is now known that it is unsafe to depend on intelligence tests exclusively, particularly on the results of one test. There are now on the market a great variety of achievement tests, diagnostic tests, inventory tests, aptitude tests, and many others The rural teacher should make use of modern measuring instruments, but she must never forget also to use her common sense in classifying pupils.

9 It has been suggested that "several bases be used either singly or in combination for purposes of classifying pupils by

ability. Among these are (1) personal judgment of the teacher, (2) school marks and progress records, (3) standard test scores and educational age, (4) intelligence quotient, (5) mental age"

No doubt the teacher should consider many factors in determining any child's place in school Standard tests and home-made tests should be used, but such elements as the child's health, disposition, and home environment should likewise be taken into account By repeated testing, endeavor to discover the child's native ability, which is of course the chief factor determining his progress. Age, size, family advantages, spirit, attitude are all important and should be considered along with other criteria *Ability to read* is an important factor particularly in the lower grades Re-examination and reclassification should take place whenever the evidence warrants

**Grades and classes.** "The maximum number of grades for a one-teacher school is eight; in reality this is too many to be handled successfully But since there are so many schools in which this condition necessarily exists, any discussion of the program for the one-teacher school must take into account the possibility of eight grades being represented Sometimes there are two or three divisions in the first grade, due to the fact that beginners have entered at different times during the year. Something should be done to stop this practice A teacher in a rural school should not be expected to form more than one beginning class during the year The time to start that class is in September If a child reaches the minimum school age in December, and his parents insist upon his starting school as soon as he arrives at the legal age, he should be permitted to enter school in the September before Otherwise he should remain at home until the following school year Occasionally a one-teacher rural school is found that is attempting to do ninth-grade work Such a procedure should not be permitted It should be borne in mind that a one-teacher school *is an elementary and not a secondary school*" [1]

[1] EDITH A LATHROP—*Rural School Leaflet No 10, The Organization of the One-Teacher School,* Office of Education (Out of print)

**Disadvantages of the graded system.** Rural teachers especially need to realize that the great American graded-school system is an artificial, man-made invention with certain advantages and with many evident disadvantages. The greatest weakness of the eight-grade plan is that the child may become the victim of a rigid, cast-iron mechanism which retards true progress. A rural teacher should always consider the individual needs of her pupils in carrying out any classification scheme or in the forward movement of the various groups The chief requirement is the progress of each child at his own rate regardless of formal promotion regulations.

**Flexibility a prime consideration.** The rural teacher may have much freedom and much flexibility in the classification of her school if she has the proper educational objectives and if her work is governed by correct principles She may have complete control of the situation if she is a good manager. Children vary greatly in ability Some can never satisfactorily complete the work of the eight grades, while others can master the subject matter and acquire the essential skills in less than eight years. If the teacher knows the abilities of her children, she will maintain a flexible classification system moving each child on in each subject as his accomplishments will warrant.

**Present emphasis on the individual** In the best schools today the interests of each child are placed above everything else. We now have tests which will discover individual abilities, we have the machinery for individualized instruction. The rural teacher should make much use of the best workbooks in various subjects; she should stress the best practices in directed study, both of the individual and of groups. In classifying her school the teacher should combine grades and classes as much as possible so as to reduce the number of classes to the minimum. If the activity or the project ideas are given prominence, then classes as such will take a subordinate place. The entire school will often be used as a unit for purposes of instruction, each child taking part according to his individual interests and ability. It requires a teacher of more than ordinary ability to

make use of such teaching-learning procedures. Whatever the procedure, the needs of each child should be placed first.

**Is there a practicable middle ground?** Is there a happy medium somewhere between the old formal lesson-hearing with twenty-five or thirty classes a day and an extreme activities program? The writer believes that there is just that. The rural teacher should consider her grades and her classes and she should have a program of recitations. These recitations must not, however, be formal and mechanical, and they must not be mere testing exercises. The success of the rural teacher will be determined by her point of view and her aims. While, on the one hand, she may well have a systematic classification of pupils with a certain emphasis on grades, on the other hand, in her instructional procedures, she should make individual interest paramount.

**Conference, and discussion, not recitation.** "When a part or all of the lesson assigned has been studied, it is then profitable for the class to meet with the teacher to talk over what has been done. The purpose is not to call on each pupil to repeat or recite what he has learned to convince the teacher that he has learned but to tell the class what he thinks or has learned. It is in order for the teacher to ask questions to get the pupil to think and for the pupil to tell what he thinks. If other pupils think differently, it is in order for them to tell what they think. This is an exchange of thought, not a recitation or a testing 'stunt.' The most successful class discussion occurs when the pupil asks questions to get the thought of his class-mate or of his teacher. If he does not understand he says so, for he has come to class to get help, to get the matter cleared up. The teacher should manage to get the timid one to take part by calling for a contribution from him that she knows he can make. Soon he will readily express himself for he knows that the teacher is not trying to find out how little he knows, but rather to help him. This is both a study and a teaching period. The pupil is trying to learn and the teacher is trying to help him. The pupils are studying and teaching each other. The teacher is working

with them and learning much that will enable her to help them more." [1]

## Daily Schedule of Classes

**Why have a program?** In the older books on management the authors had need to discuss the reasons for a program, for the average rural teacher had either a poor program or none at all. Today in all of the more progressive states a definite daily schedule for the guidance of teachers is usually printed in the state manual or course of study. There is great variation in practice In general, a good program is a great saver of time and energy Our modern life is necessarily determined in large measure by time schedules of some sort, pupils should be trained to do work on time, in accordance with businesslike procedures and time- and energy-saving devices. A good program prevents overemphasis on certain subjects and secures proper adjustment and correlation between study and recitation We now know that individual and group study, both supervised and unsupervised, should receive the major part of the teacher's time and attention, rather than recitation The Hoffman Illinois program[2] is based on this principle

**Old and new in programs.** Since the first edition of this book was published, very decided steps have been taken in several states to secure a better type of daily program for the rural teacher. The old emphasis upon a succession of twenty to thirty testing recitation exercises is gradually disappearing. Under the old plan the rural teacher called her classes to the front in regular succession day after day, whether there was any need or not The old program stressed recitation. The new program stresses individual study and activity under the teacher's direction. In some states the week is being used as the unit of time.

[1] *The Rural One-Teacher Schools of Illinois*—Circular No 263, 1932

[2] Hoffman, U J—*Organizing and Conducting a One-Teacher School in Illinois* A very useful sixty-three-page bulletin formerly issued by the State Superintendent of Public Instruction, Springfield, Ill This bulletin is now superseded by Circular No 263, 1932—*The Rural One-Teacher Schools of Illinois*

A teacher allots say eighty minutes a week to the upper class in arithmetic She may now distribute this available time as the needs of the pupils require She may have two class exercises during the week, or more or less, according to circumstances. The teacher who understands that the chief business of the school is to see that pupils learn will center her program of work around study rather than recitation. By using the new type of written tests a great deal of time may be saved The old oral question-answer testing farce should, for the most part, go by the board For the younger children class exercises are needed daily; but increasingly with the older pupils there must be a great deal of independent study of books under the teacher's direction For pupils who can study and work successfully at their seats the teacher should have class discussion periods only when the work requires this

**Aims in program making.** 1 The program must provide for a proper amount of work for each child When the program is made up, the teacher should note whether each pupil has a fair proportion of the time in each of the four quarter-day divisions Each child should have about five exercises or study-recitations a day, or opportunity for that number, so as to receive adequate personal instruction from the teacher

2 In the apportionment of time the relative importance of the various subjects requires attention For example, a good deal of time and attention must be given to reading and language in all grades, for these subjects are fundamentally important.

3 The pupil's physical condition needs to be considered; the teacher should know the favorable and the unfavorable periods as far as fatigue is concerned Every rural teacher will find it of great advantage to understand the nature and laws of fatigue. She will then value periods of relaxation and rest more than some teachers seem to do.

4 The time allotted to each class should be determined by the nature of the subject, the age of the pupils, and the number in the class Reading should have more time than arithmetic or history, the older pupils need longer class periods than the

younger, in general, and a class of two doesn't require as much time as a class of six.

5 In order to reduce the number of classes in a rural school, it is necessary both to combine and to alternate classes Five recitations a day for each grade would mean forty classes a day, and that is entirely out of the question It would be highly desirable if no rural teacher had more than fifteen so-called recitations a day, and better not more than a dozen. These should consist largely of discussion exercises, study-recitations, and periods for getting started in new subject matter All pupils in a rural school should be given ample opportunity for directed oral expression of various types Groups, large and small, should furnish the audience situations. If study is made the governing factor, rather than recitation, class periods can easily be reduced to fewer than fifteen or twenty per day.

6. No program will apply equally well to all schools A general program for an average or typical rural school can be made out; but if a teacher has only six grades she can give more time to certain classes and to the supervision of both individuals and groups

7. The teacher should not count too much on pupil's work at home Such work should be quite limited as to the amount and the kind to be done if the child is to make the best progress

8 Deliberate plans should be made to secure a proper variety of work; the teacher should arrange to have periods of rest and relaxation follow periods of work At least there should be such change of work that no child will become unduly fatigued. The teacher, too, needs to find time to look after the seatwork

9. Such subjects as writing and drawing usually come just before the afternoon recess, when there is likely to be better muscular control than immediately following vigorous exercise.

10. In adjusting the program and in carrying it out day by day the teacher should consider herself as well as the pupils. There must be no hurry and no worry if the best kind of work is to be done. In no sense should the teacher become a slave to her program

**Guiding principles in program making.** Perhaps the best brief general discussion of the problem of program making for the rural teacher is found in *Rural School Leaflet No. 10,* formerly issued by the United States Office of Education This twelve-page bulletin was written by Miss Edith A Lathrop, who first makes a clear statement of the problem and then considers various means of solution It is now generally accepted that at least four expedients are controlling and essential in solving the problem of the daily program for a rural school They are grade grouping, correlation of subject matter, alternation of subjects, and alternation of grades

*Grouping* The most common and satisfactory grouping of grades, in which the eight grades are organized into five groups, is as follows. group one—grade one, (E), group two—grade two, (D), group three—grades three and four, (C), group four—grades five and six (B), group five—grades seven and eight, (A). For most of the work of the school this means Classes A, B, C, D, E This arrangement is now in use in many states By stressing groups or classes A, B, C, etc , the emphasis on grades, as such, will be much lessened, as is greatly to be desired.

*Correlation of subject matter.* Correlation of subject matter has long been practiced in both rural and urban schools In the lower grades it is now the usual practice to correlate reading, language, and spelling Language and civics and language and history are common correlations It is not unusual at the present time to present health lessons for the first five grades in general exercises In the third-and-fourth-grade class—the C class—home geography is readily correlated with reading.

*Alternation of subjects* It is not necessary that every class recite every day in every subject. It is entirely possible to use the principle of alternation, thus securing fewer class exercises and more time for each one. Drawing for the entire school may be allotted two twenty-minute periods a week and writing to three. The A class may have history three days in the week and civics two days, if necessary Sometimes it is better to teach civics for a half year and history for a half year than to practice

weekly alternation This plan will result in more continuity and concentration, as a rule In some successful rural schools a Monday period is devoted to music for all the school, Tuesday to drawing, Wednesday to nature study, Thursday to writing, and Friday to construction work If a good thirty-minute period is used each day, the results are more satisfactory than when several short periods a day are used

*Alternation of grades* Perhaps this is the most helpful of all the proposed principles for the reduction of the number of classes and for the general improvement of the program It is now used in many states and is a necessary correlative of the grade-grouping plan discussed above The scheme has been used in Illinois and other states for many years The reader is referred to the Rural School Leaflet No 10 mentioned above for an adequate exposition of the idea—pages 4, 5, and 6

The basic fact, upon which the device of alternation of grades is founded, is that the traditional order of topics in the teaching of many subjects is not necessary or vital If, for example, pupils have a general knowledge of geography as a result of studying all of the first book of the two-book series, it is then immaterial whether they study the subject matter for the seventh grade or the eighth grade first So, in the odd years (1935-1936) the eighth-grade work may be taken, and in the even years (1936-1937) the seventh-grade work In some states, this principle of alternation of grades by years is carried out for every subject for the fifth and sixth grades The plan works readily in such subjects as reading, but is more difficult in arithmetic However, we now know that the old-time order of teaching the multiplication table, to illustrate, is not essential and, indeed, not the best So the 5's, 6's, 9's, 10's, and 11's may be taught in the odd-numbered years, and the 3's, 4's, 7's, 8's, and 12's in the even-numbered years

By alternation of grades the third-, fifth-, and seventh-grade subject matter may be taken in the even-numbered years and the fourth-, sixth-, and eighth-grade material in the odd-numbered years. It is not necessary or wise to make use of alternation in

grades one and two. But for the other grades, by grouping and alternation larger classes will be possible, longer periods can be used, and the number of classes is reduced It is not advisable for any teacher, by herself in a single school, to inaugurate this system Alternation by grades and years should at least be county wide in extent, it is much better to have the entire state for the administrative unit so as to secure uniformity and to prevent confusion

**Attention and fatigue.** A rural teacher should understand the exhausting effects of continued attention, and the program should be arranged in such a way as to reduce the occasions for undue fatigue to the minimum Small children can give attention for only a limited time, for them a change of activity should be provided at frequent intervals The best work can be done the first hour of the morning After good recess periods and at the close of the noon hour children are able to work hard on the tasks of the school Those subjects calling for least effort and attention should be placed during the second half of each quarter-day session, so far as practicable The way in which the teacher carries on the work of the school has much to do with the conservation of her own nerve force and has a pronounced effect upon the pupils If the teacher is nervous and impatient, she will induce and maintain a feeling of strain in the whole school which is exhausting and detrimental to all parties concerned On the other hand a calm, good-natured teacher will produce a soothing effect; there will be much less waste of nervous energy

The symptoms of fatigue may be due, often are due, to lack of interest in the work of the school. *Boredom* or *ennui* would be better terms to apply to the condition in which we often find pupils in the rural as well as in other schools If the teacher is lacking in personality or uses crude teaching procedures, the children may seem excessively fatigued, when, as a matter of fact, they are merely bored by the monotony of the day's work. It is probably true that very few children in the rural school ever suffer greatly from genuine mental fatigue Commonly

the subject matter is unwisely selected and not adapted to the child's mentality and stage of progress This will result in lack of interest and attention accompanied by evidences of so-called fatigue Badly contaminated schoolroom air, where ventilation is practically nil affects the nervous system, including the brain, and thus the child's mental condition Poisons generated in the intestinal tract, due to imperfect elimination, are a prolific cause of that tired feeling in both children and adults

**A program of the better type.** For several years a new type of program has been in use in several northern Illinois counties. This program, which gives due and proper emphasis to individualized instruction and directed study, both for individuals and for groups, is the work of U J Hoffman, who, up to the time of his death, was an enthusiastic advocate of this idea for one-teacher rural schools Miss Lathrop in the *Bulletin* referred to above says that "When some recitations are omitted, the teacher must allot the time as the number of recitations require. If all the time allotted to classes which do not recite is more than is required to give individual help to those classes, more time can be given to the classes which do recite The pupil's study time is also adjustable He has the whole period, less the time spent in recitation, to study a subject If he needs more time for one than for another, he can divide the periods to meet the requirements."

In Circular No 263 on The Rural One-Teacher Schools of Illinois, issued in 1932, State Superintendent Francis G. Blair had this to say about the Hoffman plan "This circular also contains a suggested plan for the organization and instruction of one-teacher and village schools This plan originally was worked out by the late U. J Hoffman and has been nationally recognized as one of the most forward-looking suggestions which has been made to rationalize and make really educative the processes of teaching the one-teacher school The plan requires a well-trained and experienced teacher to put it into operation. But in school districts where this plan has been adopted, the results have more than justified the expectations of those who have sponsored it."

## DAILY PROGRAM FOR INDIVIDUAL INSTRUCTION AND DIRECTED STUDY IN ONE-TEACHER SCHOOLS (ILLINOIS)[1]

I First Session—8 45 to 10 40

| Begin | Time | Subjects | Classes | Instruction—Class or Directed Study |
|---|---|---|---|---|
| 8 45 | 15 | | | Greeting pupils |
| 9 00 | 10 | General Exercises | All | Singing, storytelling, reading—current events, nature study, etc |
| 9 10 | 20 | Reading | (5–6) (7–8) | Directed study for class that will not have recitation at 10 o'clock. |
| 9·30 | 30 | Reading | 1, 2, 3, 4 | 1 and 2, class instruction daily<br>3 and 4, class or directed study as desired |
| 10 00 | 15 | Reading | (5–6) (7–8) | Class instruction for those who did not have directed study at 9 10 |
| 10·15 | 15 | Writing and Spelling | All | Class instruction in each subject on alternate days |
| 10 30 | 10 | Rest | All | Physical training and games |

II Second Session—10 40 to 12.45

| Begin | Time | Subjects | Classes | Instruction—Class or Directed Study |
|---|---|---|---|---|
| 10:40 | 20 | Arithmetic | 5, 6, 7, 8 | Directed study for those who will not have class at 11 30 |
| 11.00 | 30 | Reading and Arithmetic | 1, 2, 3, 4 | 1–2 reading and numbers as desired<br>3–4 class or directed study as desired |
| 11.30 | 30 | Arithmetic | 5, 6, 7, 8 | Class instruction for those who did not have directed study at 10 40 |
| 12 00 | 45 | Noon Intermission | All | Lunch and organized play. |

Third- and fourth-grade classes in reading can usually be combined It is not always advisable In arithmetic classes should not be combined.

[1] Reproduced with permission of the Illinois State Department of Education

III Third Session—12 45 to 2 40

| Begin | Time | Subjects | Classes | Instruction—Class or Directed Study |
|---|---|---|---|---|
| 12·45 | 20 | Grammar | 5, 6, 7, 8 | Directed study for those who will not have class at 1 30. |
| 1.05 | 10 | Reading and Language | 1, 2 | 1 Reading daily<br>2 Reading and Language on alternate days |
| 1 15 | 15 | Language | 3, 4 | 3 and 4 may be combined If not combined have directed study for each on alternate days. |
| 1.30 | 30 | Language and Grammar | 5, 6, 7, 8 | Class instruction for those who did not have directed study at 12 45. |
| 2 00 | 30 | Physiology and Civics | (5–6) (7–8) | A half year in each, or on alternate days Class or directed study as desired |
| 2.30 | 10 | Rest | All | Physical training and games |

IV. Fourth Session—2 40 to 4·00

| Begin | Time | Subjects | Classes | Instruction—Class or Directed Study |
|---|---|---|---|---|
| 2.40 | 20 | Construction and Nature Study | (1–2) (3–4) | 1 and 2 construction work daily<br>3 and 4 nature study daily. |
| 3·00 | 30 | History | (5–6) (7–8) | Classes to be combined Have recitation or directed study as desired |
| 3 30 | 30 | Geography | (5–6) (7–8) | Classes can advantageously be combined Have recitation or directed study as desired. |
| 4 00 | | Dismissal | | |

In the last afternoon session time is not specifically assigned for directed study and individual instruction A part of all of each period may be used for recitation or directed study, as will best serve needs of pupils

*Note.* This program is printed as found in the Illinois Circular No 263, 1932. At the present time this plan is being used successfully in many rural schools in northern Illinois The latest circular or bulletin (1932) of the Illinois State Department of Education gives a somewhat different program arrangement than that of the original Hoffman Bulletin of 1923, but the general idea is the same.

## SUGGESTED DAILY PROGRAM—GRADES 1–8 *

### ONE-TEACHER RURAL SCHOOL (STATE OF OREGON)[1]

| BEGIN | APPR. TIME | SUBJECT | GRADE | GENERAL EXPLANATION AND DIRECTIONS |
|---|---|---|---|---|
| 9 00 † | 5 | Clearing Period | All | Health inspection, general plans for the day, flag salute or group singing, etc |
| 9 05 | 30 | Reading and Language | 1, 2, 3 | Divide time as seems most profitable |
| 9.35 | 35 | Language and Health | 4, 5, 6, 7, 8 | Class work or directed study on alternate days 4, 6, 8 one day. 5, 7 alternate days Make provision for oral language. Part of this period each week used for health and physical education, all grades |
| 10 10 | 20 | Music—Art | (1–4) (5–8) | M. W Grades 1–4 have music and grades 5–8 have art Tu Th grades 5–8 music and grades 1–4 art Fri 10 min for grades 1–4 and 10 min. grades 5–8 for music appreciation |
| 10 30 | 15 | Recess | All | Supervised play or occasional project activity work Ventilate schoolroom well |
| 10 45 ‡ | 15 | Numbers | 1, 2, 3 | Followed by seatwork on numbers for 20 min Then 20 min for creative art and dismiss grades 1, 2 at 11 40 |

* Additional physical education can be worked into the daily program at opportune times in the teacher's discretion

† *First Quarter Day* The purpose of health inspection can be attained by having pupils present themselves to the teacher individually as they come to school Language activities can be worked in nicely with primary reading During the language and health period, stress oral language practice and combine all 8 grades for health and physical education occasionally In the music-art period, the teacher will take a few minutes at the opening of the period to get the group working on art started While doing this the music group can continue with their regular work or may be asked to learn the words of a song, sketch a picture illustrating a song, or work on some similar music activity until the teacher is ready for them

‡ *Second Quarter Day* The suggestions in the course of study for primary grades arithmetic should be followed and the presentation should be informal For procedure in the upper grades follow suggestions in course of study and also review the paragraph on "Specific Example of the Long Period Program in Arithmetic," p 10 Drills should be short and stimulating For spelling follow the procedure in the 1933 course of study which will be found different from the procedure in the old course When primary pupils are dismissed

[1] Reproduced with permission of the Oregon State Department of Education

| Begin | Appr Time | Subject | Grade | General Explanation and Directions |
|---|---|---|---|---|
| 11.00 | 40 | Arithmetic | 4, 5, 6, 7, 8 | Class work, when necessary to introduce new work or clear up difficulties common to several pupils Directed study work for all grades with the teacher giving guidance and assistance to individuals or small groups. Make provision for drill work for all grades at least once each week |
| 11 40 | 20 | Spelling | 3, 4, 5, 6, 7, 8 | Follow suggestions in the course of study in spelling Combine spelling with writing practice when feasible. |
| 12 00 | 55 | Noon | | Lunch—recreation. 5 min to put away play materials, wash, comb hair, etc |
| 1.00* | 15 | Opening Exercises | All | Choice of Literature appreciation, current events, nature study, health topics, safety and character education, possibly one each day of week |
| 1 15 | 35 | Reading (Geog 3) | 1, 2, 3 | Divide time as seems most profitable Word recognition drill. Use geography text as supplementary reader for 3d grade Grades 1, 2 join in 3d grade geography occasionally |
| 1:50 | 30 | Reading and Health | 4, 5, 6, 7, 8 | Two grades at least have some oral reading each day Others silent reading Reading and agriculture in 8th alternated by semesters or by units Use health texts for supplementary reading and combine upper grades in health class at intervals |

early for noon and for afternoon, the teacher should make provision for wholesome play activities outdoors, or creative work indoors This is true, particularly, where younger children have to wait in the afternoon for the bus or for older children before going home A convenient play corner in the schoolroom for primary pupils will help to solve this problem

* *Third Quarter Day* The suggestions under opening exercises give the teacher a wide choice and this period each day should be made interesting and stimulating In the primary reading period, grade 1 might be divided into a fast and slow group occasionally with an

| Begin | Appr Time | Subject | Grade | General Explanation and Directions |
|---|---|---|---|---|
| 2 20 | 10 | Writing | All | M W. F Drill work. Tu Th. Writing practice, dictation, etc Combine writing with spelling work when feasible |
| 2·30 | 15 | Recess | All | Supervised organized play whenever possible Ventilate schoolroom well. |
| 2 45* | 40 | Geography | 4, 6, 5, 7 | Grades 1, 2, 3 usually dismissed but if remain have grade 1 do word study and grades 2, 3 study reading or spelling for a short period Alternate recitations with two grades having class work each day All grades can be combined for work occasionally |
| 3.25 | 35 | History and Civics | 6, 7, 8 (4–5) | Grades 4, 5 do silent reading in history Grades 6, 7, 8 have socialized recitations alternated as desired Combine civics with history work in all grades |
| 4 00 | | Dismissal | | Desks cleared Questions answered and day's work completed Good-night greeting |

older pupil handling one group Combine all grades in the school for an audience reading period occasionally Encourage supplementary reading In the writing period on Tuesday and Thursday use practice or dictation exercises, spelling words, etc, as a means of acquiring good writing habits Occasionally a Friday afternoon period may be utilized for art or for club activities

* *Fourth Quarter Day* During the fourth quarter day, the teacher will find it desirable to work out a definite plan of alternating the class work in both geography and history depending upon the size of the various grades, work to be covered, and nature of the assignment If possible, these alternations should be made so that grades 6 and 7 will not have both history and geography class work on the same day Make provision for play or creative work for primary pupils who must wait for the bus or for older pupils Take a few minutes just before dismissal time to bring the work for the day to a finish, clear up questions, etc Pupils and teacher alike will enjoy the feeling of a day well ended

**Generalized comments on daily programs.** The following statements will apply to many programs found in various states. If these suggestions are considered in connection with the plan of individualized instruction and directed study, the

teacher will be able to do more effective work and with less hurry and confusion

(a) *Study and recitation periods* A large number of one-teacher schools still make use of a program of about twenty recitations It that is the case, then the study program is a definite part of the schedule Many authorities say that pupils should be given an opportunity to prepare lessons just preceding recitation periods, when possible In any case, pupils should not study just to recite They should study to learn However, the use of definite study periods will train children in systematic habits of work, which is highly important

(b) *Grouping of grades* In many states grades three and four, five and six, and seven and eight are grouped respectively in reading, language, spelling, arithmetic, history, and civics Sometimes larger groupings are entirely possible Many times civics and geography are completed in the seventh grade Grades one and two may be combined in language and history Grades six and seven are often put together in geography

(c) *Recreation periods* In many schools the smaller children in the first four grades are allowed to go out to play before the older ones go. Recess and noon periods are thus considerably longer for lower grades than for upper pupils The smallest children may be dismissed about three-thirty in the afternoon This arrangement will be advantageous for both teacher and pupils providing the teacher is sure that *no harm, physical or moral, is possible or likely for these younger children.*

(d) *Library reading* Supervisors and teachers now understand that definite provision should be made on the program to give all the pupils abundant opportunity for making good use of library books The more good books the children read the better, and, moreover, such reading has a direct bearing upon school progress

(e) *Provision for experiments and excursions* The last period of the day is frequently given to the pupils of the two upper grades Agriculture should be offered in the fall and spring months, that is, in two three-month terms This last hour or

half-hour is a favorable time for objective work of various sorts, when specimens can be studied and experiments performed. If the agriculture class is studying corn, for example, they may go with the teacher, and perhaps with some or all of the fifth- and sixth-grade pupils, to a neighboring farm, where they can actually see a farmer select seed corn or test such corn in the spring for viability. It should be feasible, at least occasionally, to leave the school building about three-thirty or a little before that. Such a plan is possible only with the consent of the school board.

(*f*) *Number of so-called recitations.* No school should ever have over twenty class periods a day, fifteen would be better. Where some grades are lacking, the number of recitation periods can be reduced. No country school should ever have the seventh and eighth grades, in any case, but many will continue to have these upper grades for years longer.

(*g*) *Time for periods.* For the smaller children ten to fifteen-minute periods every day in all their classes are of course necessary. Perhaps for the first three grades there should be reading and language exercises twice each day; if there are several children in a class, fifteen to thirty minutes will be needed. For classes in the upper grades it is much better not to have periods every day and to make them longer, say, thirty minutes or even forty minutes. The author has frequently seen recitation periods almost wholly wasted in the reproduction of dead textbook facts demanded by a mechanically minded teacher. The periods were short, but all the time was wasted. There should be a fifteen-minute general exercise period, and two fifteen-minute recess periods. The noon period should be full sixty minutes, as a rule.

(*h*) *Provision for each child.* The program should take care of every child every day. This does not mean a formal recitation in every subject every day, by any means, if that is ever needed. It is essential that the teacher arrange to have each pupil make some progress every day in reading, language, numbers, writing, music, art, and whatever else is on the individual's program.

Often study recitations and supervised-project activities at the individual desks will take the place of testing recitations.

(*i*) *Adjustment periods.* It is quite possible in rural schools to provide for adjustment periods on the program Retardation is lessened if backward second-grade pupils are given first-grade drill exercises which they may need; the program is often arranged to provide for this. This is a single illustration of what many progressive teachers are now doing

(*j*) *Eight years not always required.* It is not always necessary to spend eight full years on every subject For example, if geography and civics are taught as social studies in the lower grades and then later as separate subjects, they may well be completed by the end of the seventh year There will then be no civics or geography class in the eighth grade. Some authorities feel that too much time is spent on arithmetic and that more time should be spent on the social studies, starting with the first grade.

(*k*) *Alternation of subject matter* One of the conspicuous examples of a good program as it is found in some states is the alternation of all subject matter by years in the grouped classes. For example, *weeds* may be taught in September of the even years and *corn* in September of the odd years *Potatoes* may be found in the course for odd years only; and so on with other subject matter History need not be offered as an eighth-grade subject in the eighth grade of the even years, but in the odd years only This principle of alternation has a wide application and will have a beneficial effect in several ways.

(*l*) *Supervised play.* It is very common now to find the noon hour divided into two parts of one-half hour each, the first for lunch and the second for play under the teacher's supervision. As a rule, there should be a full hour's nooning; it will be best for the teacher to play with the children for at least fifteen minutes during the noon hour She needs the exercise and the out-of-door fresh air The schoolroom should be thoroughly ventilated while the teacher is on the playground.

(*m*) *Types of class exercises.* Rural teachers should sharply differentiate class-instruction periods, class-recitation periods,

and directed-study periods The instruction period is the teacher's opportunity to present the new problem, to lay out the work, and to give full and adequate directions and assignments to occupy the study time of the pupils for two days or longer When the work has been done, the class meets to discuss matters Mistakes are corrected, needful supplementary material presented, and practice exercises conducted The directed-study period is exactly what the name indicates During this time the teacher helps individuals, particularly the weaker ones If two or more pupils need an additional discussion period, they can meet for that purpose while the brighter ones go on with work at their seats

(*n*) *Get the main idea* The rural teacher must bear in mind that her program problem is to have fewer classes and longer class periods Plan for exercises with the entire school as much as possible Consider the welfare and progress of each child chiefly Make much of silent reading and of oral and written language work Lay out all work carefully. Give complete directions for doing the work. Make use of modern workbooks.

(*o*) *Relation of teacher and pupil* "The most important work done in the school is the pupil's work It is usually called *study* Any effort made by the pupil to learn or to achieve is designated as study The program then should be primarily a pupil's program What the teacher has to do is secondary to what the pupil has to do The teacher is only the pupil's helper This is the relation not only in learning and achievement, but also in conduct and behavior. What the pupil should do is of first consideration, what the teacher does is secondary There are many times when the teacher's desires for the pupil's good come first and must control"

(*p*) *For what should the program provide?* (1) "The program should provide for ample and uninterrupted time for the pupils to study each subject and do the necessary exercises (2) The program should provide for ample time for the teacher to get everyone started in his work at the beginning of a session (3) The program should provide time for class instruction, co-

operative study, class discussion, and testing (4) The program should provide time for the teacher to give individual instruction, to help pupils who did not get effective help in class instruction or for other reasons cannot do their work (5) The program should provide time for 'general exercises' such as are participated in by all pupils singing, story telling or reading, current events, morals and manners, etc (6) The program should provide time for recreation and play "[1]

**Posting and using a program.** In most rural schools the best way is to place the program on a large sheet of strong Manila tagboard, about 36 inches by 24 inches in size This sheet should be posted where all can see it Some teachers use a chart-printing outfit to make the program, this is usually neat and easily readable. Other teachers use heavy black marking crayon It will not be advisable to place the program on the regular blackboard surface for the reason that there is usually no space to spare for this purpose However, a large sheet of slated cloth can be used over and over again for the program Moreover, changes can easily be made when such a slated surface is used. The program should be very carefully and neatly done; then it should be securely fastened up in a conspicuous place

After the program has been made out in the best possible way for the particular school, the next problem is to follow it in an intelligent and sensible fashion The teacher should adhere to the time schedule with as much precision as the circumstances will warrant, but she must not become the slave of any program Provision must be made for change and variation to suit the exigencies of the situation—the school, the teacher, the classes It is possible to have both a methodical, businesslike regularity and a flexibility which allows for extras, substitutions, and alterations

The Pennsylvania Program, which is detailed but flexible, is presented in the Appendix of this book. It is very suggestive and will repay careful study

[1] Points *o* and *p* are used by courteous permission of the Illinois State Department of Education

## REVIEW, TEST, AND PROBLEM EXERCISES

1. Make out a program for a one-room rural school comprising the first six grades only

2. In classifying pupils in a rural school what are the modifying conditions which should be taken into account by the teacher? Consider the relative value of native ability, or intelligence, and various attributes of personality

3 Make out your ideal program for a rural school of only twelve pupils, in which grades two, seven, and eight are lacking.

4 If your predecessor has left no record of the classification of the pupils, what will you do the first morning? How can you have your pupils fairly well classified by the second day?

5 In your opinion should the course of study be based upon a single series of textbooks? State advantages and disadvantages

6. If a rural teacher places most emphasis on directed study, learning, and class instruction-discussion exercises rather than testing recitations, what difference will it make in her educational results?

## REFERENCES FOR THE TEACHER'S READING AND STUDY

1. CASWELL, HOLLIS L —*Program Making in Small Elementary Schools,* George Peabody College for Teachers 1930 77 pages 25¢.
2 *Course of Study for Elementary Schools,* State Department of Public Instruction, Montana. September, 1931.
3. *Current Practices in the Construction of State Courses of Study*—Bulletin, 1931, No 4. United States Office of Education
4. DUNN, FANNIE W , AND EVERETT, MARCIA A —*Four Years in a Country School,* Bureau of Publications, Teachers College, Columbia University 1926. 173 pages. $1 40.
5. EELLS, H. L., MOELLER, H C , AND SWAIN, C. C.—*Rural School Management;* Charles Scribner's Sons 1924
6. National Education Association, Department of Rural Education—*Organization of Curriculum for One-Teacher Schools.* February, 1933.
7. *Rural Education Looking Forward,* State of Nebraska, Department of Public Instruction. June, 1933.

Students and teachers who wish to make a special study of this problem should write to the Office of Education, Department of the Interior, Washington, D C , and to various state departments However, there may be a charge for some of this material which can be

ascertained by making proper inquiry Write to the Superintendent of Documents, Washington, for the price list of publications relating to education There is no charge for it Write to the State Departments of Education of New York, New Jersey, and Pennsylvania for prices of their bulletins on programs for rural schools.

## CHAPTER X

## PROBLEMS RELATING TO CONTROL

In this chapter the term *management* is used in its somewhat narrower meaning as relating particularly to order, control, and discipline In its broader, more comprehensive aspect management has to do with all teacher and school functions, duties, and relations aside from the specific work of teaching or instruction.

**The field of management.** The school is a business enterprise involving human relationships In order to carry on the work of the school successfully, it is necessary that plans be made in detail and that teacher and pupils work together with a common purpose School management in its widest sense comprises several elements of school procedure It involves, first of all, a consideration of the necessary conditions—physical and social—which promote the true education or development of the child Under the head of physical conditions, such subjects as heating and ventilating, lighting, the blackboards, the drinking water, and sweeping and cleaning are of basic importance The mere enumeration of certain necessary conditions indicates the need for management Beside favorable conditions there is the question of the mechanics of the school—the program, the movement of classes, and similar problems A successful teacher takes note of all such matters, gives thought to them, and makes definite plans Here we also find the problem of laying out the work and getting it done, the latter involving the comprehensive problem of interests, motivation, and dynamic teaching. Finally, the general spirit or emotional atmosphere of any school is of well-recognized importance Proper management seeks to produce a wholesome tone, assuring an atmosphere of co-operative activity and of good will, and resulting in right ideals, habits, and attitudes

**Acquiring the art.** The writer has known teachers, both in the grades and in the high school, who have looked upon a study of school management with more or less of indifference and disdain. That is not the attitude of any thoughtful teacher. School management is necessary and of vital importance. It involves many details which require study, because it can be learned in no other way. It is true that many teachers learn something of this art by the trial-and-error method, which is more or less wasteful of time and effort. It is, moreover, entirely unfair to the pupils on whom the unskillful teacher does her practicing. What should we think of a physician who learned his science and art of medicine by merely practicing on his unprotected patients? As a matter of fact, sensible people do not employ a quack. But what about quack teachers? School patrons, as well as educators, are gradually coming to see that no rural teacher should begin her work without a course of professional training, which always includes management as well as method.

**Need for standards.** Today, more than ever before, standards of progress and achievement are being established in school work as in other lines of human endeavor. We now have scales in spelling and writing, for example, which enable us to judge quite accurately of the work of an individual or of a class. We are also using score cards, both for the purpose of recording judgments and as a means of stimulating to better effort. In the management of a rural school, certain standards of what is right are now well recognized by experts in this field of education. As to physical conditions we have arrived at rather definite conclusions concerning the building itself, the heating and ventilation, and the blackboards. The daily program for the average rural school is now almost beyond the stage of experiment, although there is diversity of practice. During recent years careful students of the problem have come to the definite conclusion that the old type of program, comprising twenty to thirty "recitations," is entirely wrong. The new emphasis upon individualized teaching and learning, including skillfully directed study activities, makes the traditional program an

obsolete form of school procedure In other chapters of this book standards are set up for the guidance of the rural teacher. Rural school supervisors know very well that the standards used in a modern city school in the matter of class movements, class control, and class procedure will not give good results in an average country school What we need is a special set of standards, both in procedures and management for the one-room rural school

**Physical conditions.** A good rural teacher is particular to have the physical conditions as nearly right as possible This means that she will keep her room well ventilated at all times She will air it out thoroughly at all intermissions, and she will be careful to operate the ventilating system intelligently She will see that there is plenty of light and that no child faces a strong light. Seats will be adjusted to individual pupils, as far as possible. Pure, clean, fresh drinking water will be provided The building will be kept clean and neat, and the sweeping and dusting will be done thoroughly every day The health of the child will be a main consideration with an intelligent rural teacher. Proper physical conditions will aid the teacher in matters of management and control much more than she realizes at the start

**Seating pupils.** It is best to have adjustable single desks if they can be readjusted to the needs of the different pupils So far as management is concerned pupils should be seated so that temptations to disorder will be reduced to the minimum It looks well to have pupils arranged by classes or according to size, but sometimes the teacher must depart from this plan in order to promote the ends of management However, no child should sit in a seat where his feet do not touch the floor, and no child should sit all day in a stooping posture. The nearer edge of the desk should be about two inches back of the front edge of the seat If the nonadjustable seats and desks are used, then only those of the same size should be used in the same row. In an average rural school four or five different sizes will be needed Teacher and student are here referred to Chapter VI

in this volume and to Chapter XVI in the author's *The Country Teacher at Work*

**Problem of rules.** No doubt the teacher will need rules for her own guidance; she may find it very profitable to formulate a set of rules governing the system and machinery of her school. Such rules are entirely different from those which have to do with the conduct of pupils If a teacher makes a rule that every pupil who whispers will be required to remain after school, she is tying her own hands It is usually unsafe to make rules concerning conduct, especially with penalties attached The best way to handle such matters is by individual treatment of individual cases. Do not advertise the fact that you will punish thus and so, but mete out the punishment as the occasion demands Rules pertaining to examinations, marks, or promotions are very different matters, fraught with less danger. A teacher must never make a rule unless she is sure that she can enforce it A rule must be fair and reasonable, and *it must have the public sentiment of the school back of it* Otherwise the teacher will be making a bid for a contest between herself and her pupils, which no wise teacher ever does.

**What is good order?** Teachers have different ideas of what constitutes good order Some apply the pin-drop test and others are willing to give the children a great deal of freedom. Some try to eliminate all whispering and others believe that it is proper for pupils to communicate about necessary school business or work If a rural teacher is able to make use of profitable problem-project procedures or an activities program, in whole or in part, and thus effectively motivate the work, she will have but little trouble with the question of order. It is no doubt true, however, that the average rural teacher at the present time is not qualified by personality, training, or experience to administer more than a greatly modified activities curriculum, notwithstanding certain opinions to the contrary. Moreover, the rural school environment is not now favorable for such a type of work, as a rule There is something radically wrong with the teacher's spirit, aims, and plans, if she needs to give

much attention to order. In an orderly school the children are busy of their own volition. They are not doing things simply to please the teacher, but they are working out problems which are of real interest to them personally. A school is orderly in the best way when the idea of order is a secondary one, both with the teacher and with the pupils. Educative seatwork and plenty of it should help to solve this problem with the smaller children. At the present time many rural teachers are making extensive use of a great variety of workbooks. These are usually of real educational value and are used with children of all ages, but particularly with those above the second grade. Every child who is not profitably busy in some way would be better off out of doors, when the weather is favorable.

**Disorderly teachers.** There are many varieties of disorderly teachers. Some teachers are constantly throwing monkey wrenches into the gearing instead of pouring oil into the bearings. A noisy, loud-talking teacher is always a disorderly one. By her coarse, heavy tones she jars the physical atmosphere and the spiritual and emotional as well. Her loud tones prove to be contagious, before long there is a contest going on to see who can talk the loudest, the teacher or the children. A teacher is disorderly, too, if she has an irascible temper. Such a teacher is touchy and easily flies off the handle. She is a bad example for the pupils; she does much to produce a bad spirit or tone. Some teachers are disorderly in their personal bearing. They do not dress neatly and they have, in general, a slovenly appearance. In some way this lack of physical trimness and of good bearing produces a bad mental and moral effect. Sometimes the teacher is a disorderly element because of the extreme styles of hair, dress, and the like, which she affects. She dresses so loudly or in so unrefined a manner that she attracts too much attention to herself. If a teacher keeps her desk and the library shelves in a disorderly condition, the effect will soon be manifest upon the entire school. Good housekeeping is important from the standpoint of order, the teacher's housekeeping abilities constitute a large part of her contribution to the general school situation.

**Disorderly pupils.** Of course there are almost always some disorderly pupils, particularly at the beginning of the year But it is quite possible to change a disorderly child into an orderly one by proper treatment and training Many pupils are disorderly because they have never been taught correct ideals and standards of order It is rare, indeed, to find a pupil who persists in disorderly practices simply out of a spirit of meanness A good deal of disorder comes from the fact that pupils are unable to study effectively; there is lack of proper assignments Many teachers could solve their problems of disorder if they would make more extensive use of the study-recitation and of directed study If a pupil persists in disorderly conduct, disturbing others in so doing, he may need to be given drastic treatment. Sometimes such pupils should have certain privileges taken from them Again, a private interview, in which the various elements of the difficulty are carefully and calmly discussed, will bring about the desired reform In no case should a teacher permit the disorderly conduct to continue indefinitely A pupil who persistently whispers, who does not get his lessons, who disturbs others, cannot and must not be tolerated In such cases the teacher should make a diagnosis of her own weaknesses as well as of those of the pupil. Many times the difficulty is one that pertains to teaching If a child is interested in his work, he will rarely be troublesome Poor teaching is a bid for disorder

**Movements of pupils.** Pupils should be trained to move in orderly lines. Such training is a part of the general educational procedure When pupils go to class they should pass in order, to the teacher's "stand—pass—be seated," or other appropriate signals Some teachers use the vocal signals. *one, two, three.* Whatever plan is used, there should be a general agreement and understanding, and all should obey promptly. In no case should a teacher use a jangling call bell. At recess times pupils should pass out in good order Sometimes a boy or girl may play a march on the organ or piano—an excellent plan After recess is over pupils may form in line and march to their seats

in orderly fashion If a teacher will persist in some carefully considered system of pupil movement, she will find that the general effect upon the spirit and control of the entire school is wholesome and beneficial There are supervisors, superintendents, principals, and teachers who are not in accord with these suggestions, but the author is convinced that for the average rural teacher such a plan is both proper and feasible It is good character training and works no hardship on anyone It is decidedly not a waste of time, and both teacher and pupils should take pride in doing it well Otherwise, it would better be omitted

**Teacher leadership.** The teacher is understood to be the leader In order to act the part of leader, the teacher must think, plan, and execute. A leader needs poise and self-control A leader must be sympathetic, but also firm If a teacher can be fair, frank, and firm with all her pupils, she will do much to promote her leadership and influence To be a leader, a teacher must make plans carefully and carry them out through the co-operation of the pupils. True leadership is far removed from anything which savors of the mere boss A true leader does not dominate. The old-time schoolmaster was not always a leader He was often an autocrat, a czar He did not secure and he apparently did not seek co-operation His word was law and the pupils obeyed through a sense of fear. Such methods are not the methods of true leadership When a teacher is the genuine leader in her school and community, she secures adherence to her program because it is a correct program, on the whole, and because she convinces her patrons and pupils of the justness of her cause Teacher leadership in rural communities is a very much needed element in solving the rural school problem What is needed most of all is the leadership of ideas, and of a strong, virile, positive character.

**Habit and routine.** Very much of a teacher's work has to do with the formation of habits. If a teacher has an orderly school, it will be because she and her pupils have orderly habits. Spasmodic activity, doing something today and forgetting

to do it tomorrow, will never result in good order The orderly teacher carefully plans out her activities and then makes a serious effort each day to do things exactly as planned Many a teacher has a noisy, whispering school simply because she lacks the habit of firmness herself To establish habits in school children requires persistency and self-control on the teacher's part Uniformity and regularity of action constitute the only means of habituation The mechanical procedures of the school should be routinized as soon as possible, in order to save time and energy.

**Modern co-operation.** So much depends in our modern American social organism upon the active, co-operative participation of every citizen, that the school should unquestionably prepare boys and girls for this type of society Pupils must be trained to be active participants rather than passive recipients. Such training can be secured only by shaping the program of the school in such a way that pupils take the initiative as much as possible The socialized recitation is a move in the direction of such co-operative training, although it is overworked by some teachers The school society is also an effective organization in which to develop the virtues of participating citizenship The playground, with its supervised play, affords many opportunities for teaching boys and girls to do effective teamwork. The school should be a democratic, co-operating institution which prepares boys and girls for active social citizenship

**The old schoolmaster.** The old schoolmaster has, for the most part, passed away and given place to the young schoolmistress The man teacher in the rural school a generation and more ago had some excellent qualifications for his position, but in other ways he was deficient. Usually he made the children mind; although the obedience he secured was of the forced kind and obtained largely through fear, he still rendered a useful service in this way He was also, many times at least, a master of the more difficult branches, such as arithmetic and grammar What he knew he usually knew thoroughly, he often

transmitted his passion for accuracy and mastery to some of the older pupils. He knew nothing at all about primary techniques. He taught reading by the a-b-c method. The old-time schoolmaster often had a good mind, but he knew very little about the art of teaching for the very obvious reason that he made no study of his art as such. He believed that anyone could teach if he only possessed the requisite knowledge. In instruction he taught book knowledge exclusively; in discipline he was monarch of all he surveyed and governed his school as people are governed in any monarchy. He apparently did not understand the fundamental principles of democratic government.

**The new schoolmistress.** The new rural teacher is usually a young girl whose age is somewhere between eighteen and twenty-five years. She has the great advantage of being young along with the disadvantages of immaturity. Her ways of governing her school are largely determined by her own personality or temperament, and by the training which she has received in her own home and from her different teachers. As a rule she has a pleasant, cheerful disposition and is friendly in her relations with the children and patrons. She is likely to appeal to the better nature of the child, and she secures results through natural incentives. She does not use coercion or fear nearly as much as did her old-time male predecessor. This new schoolmistress is more of the Jean Mitchell type. In 1931 Professor Mabel Carney described the typical or the average rural teacher of the United States in the Thirtieth Yearbook of the National Society for the Study of Education, Part I, p. 160. The reader will find this description in the section on securing better teachers, Chapter I.

**Why and when punish.** If a teacher is fortunate enough to possess the right personality she will not need to punish often. If a teacher finds it necessary to punish frequently and is taxing her mind to invent ways of punishment, she may be sure that she is on the wrong track. Such a teacher is animated by a wrong purpose entirely; she must about-face if she is to exert a salutary influence in building up the characters of her boys

and girls Of course punishment is sometimes necessary; a teacher must not hesitate to punish a child for his own sake and for the good of the school E E White stated that, in general, punishment may be needed to prevent wrongdoing, and, in particular, to reform the wrongdoer, to deter others from wrongdoing, and to condemn wrongdoing. No good teacher ignores bad conduct She will not tolerate lying, cheating, profane language on the playground, the marring of furniture or outbuildings, impertinent responses, or failure to do assigned tasks So far as possible she will get results through the use of natural incentives, but with some children persistence in wrongdoing must be met with suitable and effective punishment

**Forms of punishment.** It will be profitable briefly to consider first certain forms of punishment which should *not be used*, some of them being very common with certain teachers

**Wrong forms of punishment.** *Threatening and nagging* are always ineffective The teacher who threatens and nags defeats her own purpose, she does not get the results she expects Moreover, this method of dealing with pupils ultimately begets disrespect, instead of securing good conduct, it actually encourages misconduct

*Sarcasm and ridicule* cause resentment on the part of all self-respecting boys and girls and are an indication of a sordid spirit Any teacher who resorts to the use of insulting epithets, such as *blockhead* or *dunce*, needs to revise her thinking and to overhaul her motives and her conscience

The infliction of *personal indignities* upon the child's body, so-called "appropriate" or "natural" punishments, such as washing out the mouth or tying a cloth over the child's mouth, all savor of the spirit of the barbarous ages. Any teacher who feels the need of such procedures should make up her mind that she is in the wrong business

The principle of *saturation* was sometimes utilized by the old-time schoolroom czar when the child was compelled to repeat his offense to the point of fatigue If he was caught chewing gum, for example, he was made to stand before the school and

chew to the point of exhaustion The coarseness of thought and spirit shown here is revolting to every right-minded teacher, young or old.

It is legitimate and proper to require pupils to make up work which they have neglected to prepare; but it is quite inexcusable to ask a pupil to memorize poetry, for example, because he spent his time whispering When regular school tasks are used as a means of punishment, the child gets a wrong sense of proportion and of educational values When a pupil fails to get his work done because of laziness, he should be required to do it and he will see the justice of the requirement No punishment should result in a wrong attitude on the pupil's part toward school work The work of the school should be made attractive and not repulsive

**More or less suitable forms of punishment.** There are several suitable punishments, and *reproof and personal criticism* make one of the best The teacher who has a good spirit and a genuine regard for the welfare of the child will frequently use kindly, personal, private reproof as a first resort General, public reproof is much more questionable, and is usually unwise and unnecessary Children don't like to be "called down" before the entire school; such a course generally produces hardness of heart and justifiable resentment If the teacher knows the facts of the case, a personal interview will often result in much good Some of the best teachers find that reproof as a form of punishment serves practically all of their purposes

*Suspension and expulsion* are sometimes necessary Suspension is a temporary dismissal from school, say, for two or three days or a week. Expulsion means permanent banishment and is, therefore, a very serious matter. The teacher, in most states, has power to suspend unruly pupils; but expulsion is exclusively the prerogative of the board Of course no child should be expelled from school unless all other measures have failed Expulsion means permanent loss of school privileges A child may be suspended for persistent disobedience, for continued immoral conduct, for refusal and failure to do the required

work, or for continued impertinence. Whenever a teacher suspends a pupil from school, the board and the parents should be notified at once and full and satisfactory reasons should be given for such action. When suspension fails and a child proves to be incorrigible, there is no way out except permanent dismissal. A child who is persistently disobedient to the extreme of insubordination, or who is guilty of flagrant and repeated immoral conduct, or who will not do the work of the school, has no right in the school and is a menace to the rest of the pupils. It is the legal right and the duty of the board to remove such a pupil from school He should, and no doubt will, find a place in a state reform school.

*Corporal punishment* is permitted by legal enactment in most states; the courts have upheld the teacher repeatedly in the proper administration of such punishment It should, however, be used only when other means fail, but if a suitable instrument is used in the right way, it may, if occasion demands, be anything but a cruel form of punishment If more teachers would do as well by certain refractory culprits as a certain conscientious grandfather did by his willful, disobedient grandson, their pupils would rise up in the years to follow and bless those wise teachers who did not "spare the rod and spoil the child." A teacher must be careful never to whip a pupil in anger and never to leave marks of any kind on his body Be sure you are right; young or old, *be sure you are right,* be sure that you will have the co-operation of the parents and the approval of the board. Then do it well; that is to say, make it effective or don't use corporal punishment at all Most pupils should never be punished corporally, and the teacher should deliberate long and carefully as to the probable effect upon the child and upon the school In administering corporal punishment the public sentiment of the school and of the community must be entirely on the teacher's side; otherwise she may be playing a losing game. Try other measures first. *The best teachers never find it necessary to inflict bodily punishment of any sort* It is well always to bear that in mind.

*Deprivation of privileges* is a natural punishment that is effective if the privilege is real and if the child can be reached in this way It is a genuine punishment to some children not to be allowed to perform certain monitorial duties, not to be allowed to play with the others, to be refused their part on a program, to be deprived of the teacher's confidence and trust. A skillful teacher can make profitable use of this form of punishment If a pupil has been allowed to get interesting stories from the library after his lessons are prepared and if he loves to read, it will be a genuine punishment if the teacher withdraws this privilege temporarily because he neglected his work in order to read stories. Whenever possible the punishment must be adapted to the offender and to the nature of his offense if it is to prove availing and reforming

*Detention* at recess or after school may or may not be proper, according to the nature of the misdemeanor If a pupil wastes his school time, uses profane language on the school ground, or mistreats his playmates, it may be proper temporarily to deprive him of the privilege of playing with the others He must, however, be allowed to go out of doors by himself, as he needs the fresh air and the exercise as well as the others No teacher has a moral or a legal right to deprive a child of his play time Keeping the pupil after school is usually a great mistake, if parents ask to have the child come home as soon as school closes, the teacher cannot legally keep him In all these matters the teacher is not to consult her own convenience, but rather the welfare of the individual child As a matter of fact keeping in at recess or after school is a form of punishment which should be used but rarely, it is usually the resort of weak teachers

*Making restitution* is a natural and a legitimate form of punishment If a pupil destroys or injures any school property or the property of other pupils, he should make it good. Both parents and teacher should see to it that the restitution is a personal sacrifice, a result of the child's own effort and saving If the parents pay the bill, the child does not suffer; there will be no change of ideals and hence of conduct

Read Moorehouse, Page, Salisbury, and White on the subject of punishment.

**Need for obedience.** No school is successful unless the pupils cheerfully and promptly obey the directions and the wishes of the teacher. Willing obedience is the very corner stone of the school structure. So a teacher must secure true obedience or she is indeed a failure. In order to secure this result a teacher must always be careful that her requirements are reasonable and just. Most children have a sense of justice which is keener and more accurate than many teachers understand or are willing to admit. If a teacher is thoughtful in what she asks of her pupils and is uniformly firm day after day, she will have but little trouble. This means that the teacher herself must obey the law, she must have a truly obedient spirit, herself. She must be able to think out a wise and suitable program of school work and she must exercise personal self-control. Poise and serenity of spirit on the teacher's part will aid much in securing obedient responses from the pupils.

**Don't do these things.**

1. Don't stand too near the class.
2. Don't censure trifling errors severely.
3. Don't complain or grumble.
4. Don't give commands when you might give suggestions.
5. Don't dispute with an angry parent before the school.
6. Don't make spiteful remarks about parents.
7. Don't try to teach without good order.
8. Don't call for order in general terms.
9. Don't be strict today and lax tomorrow.
10. Don't punish without explanation.
11. Don't allow whispering.
12. Don't talk too much. Don't talk to your pupils when you are standing before an unshaded window.
13. Don't fail to get acquainted with the people in the district, particularly the members of the school board.
14. Don't forget that teaching and governing a school are phases of a difficult art which require study and painstaking effort.
15. Don't let your school run away with you. *Manage the school whatever else you do or fail to do.*

16. Don't forget that the best way to manage is to *give pupils plenty of interesting and profitable work to do* The teacher who succeeds in working up an abiding interest in study will have little trouble with discipline.

**Criticisms of supervisors.**

1 Pupils are not prepared for the work they are undertaking to do.

2. The school is not well organized

3. The pupils run to the teacher to ask questions while she is conducting a recitation

4 The teacher is indifferent, lacks interest.

5 The teacher spends too much time and exhausts her energies in attending parties

6 The teacher does not keep a neat and orderly desk

7. The teacher does not call school on time in the morning, at noon, or at recess

8. The teacher is slow and poky

9. The teacher fails to see or take notice of disorder

10. The teacher has not a strong grip upon the school, but "fights it out" every day as best she can

11 The people of the district are not interested in the school, and the teacher does not know how to improve the school sentiment in the community

12 The teacher is timid, afraid of the pupils, the school board, and the patrons

13 The teacher lacks life and animation, and the school is dead

14. The outbuildings are in bad condition

15 The room is not properly heated, lighted, or ventilated

16. The teacher does the janitor work, and she does not do it well The fire is not built in time to have the room warm in the morning, the sweeping is not properly done, and the dusting is not properly attended to

## REVIEW, TEST, AND PROBLEM EXERCISES

1. Make out a set of rules and regulations for your *own personal use,* by which you would like to systematize your rural school.

2. Write several adjectives describing the kind of a spirit you would like in your school Name some evidences of a bad school spirit. Indicate the chief causes in producing school spirit.

3 Draw a diagram showing how you will seat twenty-four pupils in a rural school having all the eight grades so that each child will have a comfortable seat. Write in the names, ages, and grades of the pupils You will have single desks of four different sizes and non-

adjustable Four pupils in the four upper grades are inclined to be somewhat disturbing

4. What is the happy medium between the pin-drop test and the extreme-freedom idea? Consider the bearing of project teaching or an activity program upon the problem of control in a rural school

5 Name some of the principal attributes of the teacher who is a real leader in her school and in the community Read Bagley and Keith's *An Introduction to Teaching*, The Macmillan Company, pp. 325-326, 358, and 362

6 Distinguish between a democratic and an autocratic school regime Why are co-operative methods best in training boys and girls for effective citizenship?

## REFERENCES FOR THE TEACHER'S READING AND STUDY

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# CHAPTER XI

## A BETTER AND A SOCIALIZED NOONDAY MEAL

For many years large numbers of teachers throughout the United States have been serving hot lunches at noon with definite physical and social benefits to the children in their schools Whether a rural teacher will carry on this important work depends wholly upon the personality of the individual Some teachers say that the hot lunch is too much trouble and is not practicable However, the author has known scores of teachers who have been able to render a real service in this way and have enjoyed doing it The social values of the hot lunch should not be ignored Any teacher who has the right spirit and the necessary skills may render a genuine educational service through the agency of the hot lunch Anyone can make a beginning and learn more and more through experience with this important part of the daily program—important particularly during the winter months

**Nature and importance.**

By the hot lunch is meant that part of the school child's dinner which is prepared and served in the schoolhouse in addition to the lunch brought from home This additional hot part of the meal may consist of nothing more than hot cocoa or an appetizing, nutritious soup The kind and quality of the hot food served will depend upon the teacher and upon her ability to secure the co-operation of mothers and children [1]

Home Economics Circular No 13, which may be purchased from the Superintendent of Documents, Washington, D C, for five cents, states that the advantages of hot food at noon are many:

[1] STILLMAN, GLADYS—*The Hot Lunch in Rural Schools,* Home Economics Extension Office, University of Wisconsin, Madison Miss Stillman has kindly given the author permission to use her bulletin freely

The child always eats just as much of the cold food as he did previously and receives as much additional nourishment as the total nutritive value of the hot food given him Since it is almost impossible to overfeed a rural child who walks from 1 to 3 miles in winter weather, besides playing at noon and recesses and doing some chores night and morning, the added nourishment of the school food is greatly to be desired for all children, and especially for those who give evidence of undernourishment The agreeable flavor of the hot food, its neat service, the social companionship insured where all sit down and eat together, all contribute to the conditions which increase appetite and enhance the palatability of all food eaten

Dr Mary Swartz Rose of Columbia University says

Feed a growing child properly and you have helped to make a good citizen Every child has a right to a useful body and mind, but in order to have either he must be given the right kind of food at the proper time

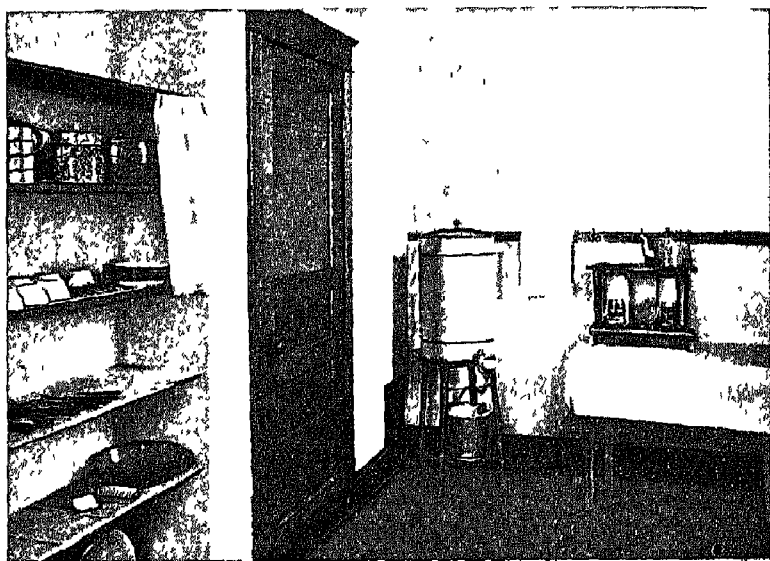
*Courtesy of College of Agriculture, University of Wisconsin*

**Hot lunch equipment**

The hot lunch properly conducted results in better health, greater enjoyment of the noonday meal, improved eating habits, better table manners, added facilities for health instruction

and training, better school work in general, and more regular school attendance

**Equipment needed.** In Miss Stillman's hot lunch bulletin the following items are given as the minimum equipment

1. A two-burner or, better, a three-burner oil stove, which can also be used by the Parent-Teacher Association or the Community Club

*Courtesy of College of Agriculture, University of Wisconsin*

**Hot lunch equipment**

2. A small table or perhaps a substantial dry-goods box The lower part may be inclosed as a cupboard for the dishes and cutlery A door in front will keep out dust and mice Lard tins or cracker boxes may serve as containers for materials attractive to mice

3 Dishes for work in preparing food A granite or, better, aluminum kettle with cover to fit, of a size according to number of pupils to be served, large long-handled spoon, teaspoon or measuring spoon, tablespoon, measuring cup, quart measure, fork, paring knives, potato masher, vegetable brush, can opener, teakettle, oven A few baking tins are useful, but not absolutely necessary A one-compartment fireless cooker made by the pupils will aid in decreasing the labor involved and in preparing the lunch. See next section on making and using such an equipment

4 Dishes for serving For each child a large cup with a handle, a spoon, and a paper napkin. These may be brought from home by each child and kept at school, or they may be supplied as part of the equipment. If these dishes are a part of the school equipment, then a low, light-weight aluminum cup of coffee-cup size for each child is the best. It is useful in serving most of the recommended dishes. Although aluminum costs somewhat more, it is the best ware to purchase and the most economical, all things considered For serving the food, especially soup and cocoa, a large pitcher is useful.

5 Cleaning equipment. Dish towels, dish cloths, cleanser, dish pans, soap, sapolio

**Making and using a fireless cooker.** The fireless cooker has definite values for every household, it makes the kitchen comfortable and saves fuel, time, and labor The making of such a piece of equipment may be a good manual training project for older pupils in those rural schools where the teacher is mature and competent

*Materials needed* [1]

1. The outside container· Any good-sized box or bucket with a tight cover—a grocery box, a butter firkin, a wooden candy bucket, a 100-pound lard can, or a new garbage can

2. Packing material. Soft hay, excelsior, ground cork, sawdust, tightly crumpled newspapers, or any other good nonconducting material that can be packed in closely. This packing material forms a nest for the cooking vessel

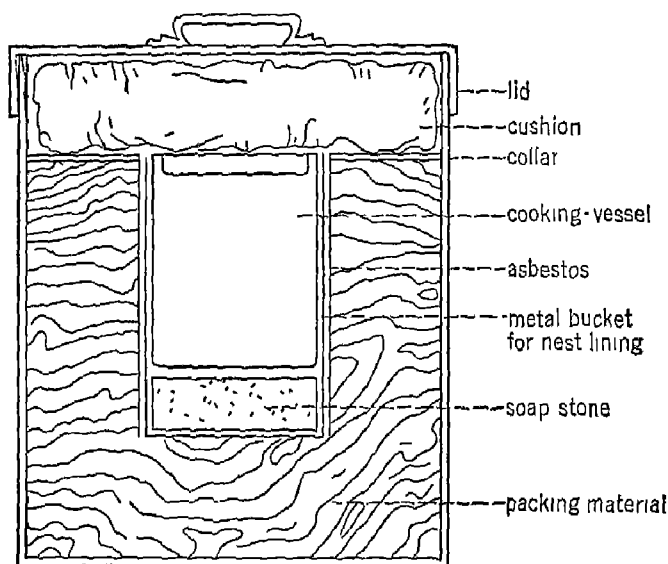
3 The nest lining: A metal or enamel bucket with sheet asbestos to cover the bucket The bucket must have straight sides and a lid, and it must be of such a size as to allow at least three inches of packing material between it and the outside container at top, bottom, and sides

4. The cooking-vessel A tight-lid vessel to fit closely into the nest lining and yet slip in and out easily, or two or three of the small ones especially made for the fireless. The best kinds are of enamel, granite, or aluminum

5 Cardboard. to make the collar.

[1] From *Farmers' Bulletin No 771, Homemade Fireless Cookers and Their Use.* This bulletin is now out of print

6. The cushion. Denim or muslin stuffed with the packing material. This cushion is to be pressed down across the top under the outside lid of the container

7. The two soapstone disks: purchasable at a hardware store. They are not needed for all cooking, but with them you can cook more quickly and in greater variety

Homemade fireless cooker

*How it is made* (1) Line the container with newspaper if a wooden box is used (2) Pack the bottom of the container compactly with a layer of packing material to the depth of three inches or more (3) Cut a circle of asbestos, two inches larger than the nest liner. Place the asbestos mat in the center of the packing. (4) Cut a strip of asbestos big enough to cover completely the outside walls of the bucket, which is to serve as the nest lining, and tie it in place (5) Place the bucket with its asbestos covering in the center of the asbestos mat Hold in place and tightly fill in the space between it and the walls of the outside container with the packing material Pack in solidly to within one-half inch of the top of the bucket The success of

your cooker depends largely upon the tightness with which you crowd in the packing material, which prevents the heat from escaping from your hot food (6) Cut a piece of cardboard to fit in the outside container. Cut a hole in the middle of it which will fit closely over the bucket which fits the nest lining This "collar" holds the packing material in place (7) Make a cushion for the top by cutting two pieces of cloth the size of the outside container and putting them together with a straight strip of cloth three inches wide Stuff with the packing material. (8) Outside finishings: If a box is used for the outside container, the lid should be hinged and fastened down with a hook. If it is of wood, paint it or stain it a dark color. Casters make it convenient to move about

*Some cautions* Don't let the food or dishes cool before you put them in the fireless The food will not cook unless there is enough heat shut up with it Reheat the food that requires long cooking, if it cools before it is finished Reheat the food before serving it, if necessary A small quantity of food cools quickly, so either use the disks or put a small vessel containing the food in the regular cooking vessel and surround it with hot water

Soapstone disks will increase the usefulness of your cooker They can be heated above the boiling point of water, when shut up in the fireless cooker, they furnish the heat which cooks the food If you made your fireless according to directions, you can safely use the disks Heat them very hot but do not let them get red hot for fear of cracking With one below and one on top of the cooking vessel you will be able to roast meat or even bake bread or puddings Without the disks your fireless is useful only for certain kinds of food—cereals, beans, pot roast, stews, things that can be cooked in water *Use the hot soapstone or cast-iron disks with caution* Handle with the metal holders and carriers. *There must be no fire hazards in a rural school*

**A successful hot lunch plan.**[1] The public health nurse of Ramsey County, Minnesota, at one time instituted a prac-

[1] Reported by Miss Edith Lathrop of the United States Bureau of Education in a government bulletin

ticable plan for serving hot lunches in the rural schools of her county, which she called "The Pint Jar Method Hot Lunch":

Each child brings some particular kind of food in a tightly sealed pint fruit jar Upon reaching school the jar is set on a rack in a clothes boiler The clothes boiler is partly filled with water and then placed on a two-burner oil stove. At the morning recess the wicks are lighted, and by noon the contents of the jars are hot

*Courtesy of the Waterman-Waterbury Company*

**The lunch warmer**

Most teachers use a homemade boiler equipment quite successfully

The children are seated at their desks during the luncheon period Monitors pass the jars The cold lunches in the basket are supplemented with the warm contents of the jars. Each child has his initials scratched on the cover of his jar in order to insure identification

It is recommended that the children bring in their jars the following kinds of food: cocoa, milk, soups, certain kinds of fruit and vegetables, macaroni, rice, creamed eggs, baked beans, or stewed meat

The equipment required for this method of serving hot lunches consists of a two-burner oil stove, clothes boiler, rack (water should reach half way up the first layer of jars, the second layer being heated by steam), hot can lifter, towel to wipe jars, and newspapers for desk on which to set jars upon lifting them from the boiler Each child is urged to include a large dessert spoon

in his lunch basket with which to eat from the jar, as a teaspoon is too short

Both teachers and children like this method because of its simplicity. It eliminates cooking, odors, and dishwashing It is economical and has proven very satisfactory This plan has been successfully used in many states by hundreds of rural teachers.

**Practical suggestions for the teacher.** *Secure co-operation and share responsibility* Before beginning the work call a meeting of the mothers and talk over your plans Impress upon them the many advantages, physical and mental, that can be derived from the serving of a warm lunch at noon. The objects are not only to add a warm dish to an otherwise cold and unappetizing lunch, but to teach the proper cooking and serving of foods and their nutritive value or relation to the body; to teach table manners, politeness, and cleanliness; to draw the pupils together in a pleasant social hour, to attract children to school who might otherwise stay away, and to enable all to go back to their work with body and mind refreshed Only when the community realizes the benefits the children will derive from hot lunches, will it co-operate with you and take the responsibility of furnishing you with supplies

*Provide equipment enough for two to four girls to work at a time.* The necessary funds for a few utensils may be obtained by giving some sort of an entertainment or a box social. If you do not have a stove with a flat top on which you can cook, you can buy a one- or a two-burner oil stove There is a good list of simple equipment given in many state manuals Each child may bring from home: a cup and saucer, plate, spoon, knife, and fork. These need not be of the best china or silverware in the home, but they should not be so nicked or cracked as to lessen their attractiveness or to develop carelessness in dishwashing. A cupboard in which to keep this equipment can easily be made by the boys from dry-goods boxes which may be obtained free or for a few cents from a local merchant The girls can make curtains for the cupboard of some cheap material, heavy enough to keep out the dust.

*Choose only simple, nutritious foods, not fancy, dainty dishes.* Teach them to cook the things which they might serve their fathers and brothers at home Study foods, find out which ones build up the body, which give us energy, and which regulate our body processes. Study the digestion of foods and the methods of preparation which make them more easily digested.

*Plan the lessons at least a week in advance* Have the pupils show the list to their mothers, so that they may know what the children are expected to bring and have it on hand the following week The mothers, knowing the week's menu, can avoid sending in the child's lunch too much protein on a day when a protein food is cooked at school, or too much starchy or fat foods when such foods are prepared

*Avoid taking too much time from the regular session* Have pupils pare vegetables before school or at recess. Shortly before noon have girls begin the preparation of food so that it will be cooked at the time of intermission. When the bell rings the pupils pass out and wash hands, spread paper napkins on the desks, get their cup and plate, and sit down quietly to wait until served with the lunch which they brought from home While eating discuss the different methods of preparing the food, its nutritive value, and its proper time or place in the diet State also the lesson for the next day While some of the girls wash dishes, have others tidy the room The boys may get water, empty the garbage, or perhaps help with the dishes Boys sometimes make as good cooks as girls, so they should also do their share of cooking

*Correlate cooking with other subjects* In geography, when studying China, prepare rice at noon; associate Italy with the preparation of macaroni In the physiology class study the digestion of the rice and macaroni and their use to the body.

*Give credit for home work* Encourage the children to cook at home and to report on their work Give a certain number of points for cooking, cleaning, or personal hygiene, and post a list or record of points This will do more to make the family in-

terested in the school than any amount of persuasion on the part of the teacher

*Vary the dish from day to day.* If your children are particularly fond of cream soups, do not destroy their appetite for them by serving potato soup every day. Try one of the following in the same proportion Green peas, cooked and mashed, corn, cooked and chopped fine; beets, cooked and chopped fine; spinach, cooked and chopped fine; celery, cooked and chopped fine, beans, baked and mashed; asparagus, cooked and chopped; tomatoes, cooked with one-half teaspoon of soda and passed through strainer; dried peas or lentils, soaked overnight, cooked, and mashed Any of these may also be served with a thick, white sauce, as a creamed vegetable.

*Make the mealtime a social time* Sit down with your pupils and be served with them. Encourage happy conversation. No hour of the day affords the teacher a better chance to learn to know her pupils and to get close to them through sympathy and understanding than does the noon hour.

*If you are not a first-class cook, it does not mean that you cannot teach a few simple dishes* Send for the *Farmers' Bulletins*, published in your state, or by the Department of Agriculture, Washington, D C.

Miss Stillman says that it is necessary to observe the following points in order that the hot lunch may be a success· (1) Make the work part of every day's program, not an additional task for teacher and pupils (2) Create a demand from parents and pupils for the hot lunch. Invite mothers to the school and plan lunches with them (3) Let the whole community share in your project (4) Prepare simple, nutritious dishes. (5) Make detailed plans for co-operation in the community and think more of the success of the project than of getting credit for it.

**The balanced meal.** Throughout life our bodily and mental activity makes two demands. (*a*) material to build up and to repair wear and tear; (*b*) fuel to burn, making activity possible, heat being converted to energy or power to do work The body, therefore, needs two chief classes of foods or nutrients: (*a*) pro-

teins for building; (b) carbohydrates and fats to maintain temperature and to furnish energy for activity A three-fold division into proteins, carbohydrates, and fats is usually given. In addition to these certain mineral salts and all of the vitamins (A, B, C, D, E, G) must be furnished in fruits, vegetables, and milk A meal, properly balanced, consists of food containing proteins, carbohydrates, and fats in the right proportions The ratio established by Atwater of the tissue-building to the energy-giving foods, is 1 to $6\frac{1}{2}$ This ratio we find in a bowl of cream-of-potato soup served with croutons or wafers. See recipes for potato and other soups in this chapter.

**An informational outline.**

*A. Getting started*

1. Plan at mothers' meeting· *a.* To obtain equipment. *b.* To care for equipment *c* To obtain kerosene.
2 Discuss at mothers' meeting *a* Time required. *b.* Division of work. *c.* Nature of food *d* Co-operation of mothers.
3 Ideas to stress at mothers' meeting *a.* Need for co-operation. *b.* Better health. *c* Good use of part of noon hour. *d.* Correlation with other subjects. *e.* Increased interest *f* Learning food facts. *g.* Better manners *h.* Knowledge of cooking.

*B Managing the enterprise*

1 Equipment (see page 202)
2. Record of supplies, as for example
   *a.* John—3 lbs. carrots—money value
   *b* Mary—$\frac{1}{8}$ lb butter—money value
   *c* Jane—2 qts milk—money value, etc.
3 Duty schedule (Note. pupils are numbered 1–10)

| | *M* | *T* | *W* | *T* | *F* |
|---|---|---|---|---|---|
| *a.* Preparing food . . | (1) | (2) | (3) | (4) | (5) |
| *b.* Cooking food . . . . | (2) | (3) | (4) | (5) | (6) |
| *c.* Serving food . . | (3) | (4) | (5) | (6) | (7) |
| *d.* Washing dishes. . . . . | (4) | (5) | (6) | (7) | (8) |
| *e.* Wiping dishes . . . | (5) | (6) | (7) | (8) | (9) |
| *f* Replacing dishes . . . | (6) | (7) | (8) | (9) | (10) |
| *g.* Straightening up . . | (7) | (8) | (9) | (10) | (1) |

4. Five lessons *a*. Potato soup, *b* creamed carrots, *c*. cocoa, *d* baked apples, *e* creamed codfish.

*C. Points to remember*

1. Interest and co-operation indispensable
2 No need of interference with other work
3 No additional expense
4 Size of school no limitation
5 Varied benefits (physical, mental, moral)

*D. Securing food supplies*

1. Make list a week in advance
2 Appoint a leader
3. Appoint a bookkeeper
4 Bookkeeper to credit family or pupil
5 Charge portion costs to pupils
6 No hardships should be permitted
7 Consider special needs of families

## Recommended recipes.

### I COCOA (Serves 12)

½ cup cocoa
½ cup sugar
2 cups boiling water
8 cups or 2 quarts milk

Mix cocoa and sugar well Add the boiling water and boil from three to five minutes This cooks the starch in the cocoa and makes it easier to digest Add the milk and set in a pan of hot water to cook till ready to serve This may be prepared before school and reheated in time to serve If a scum forms on top, beat with egg beater

### II WHITE SAUCE (Serves 12)

3 cups milk
6 tablespoons flour
6 tablespoons fat
1½ teaspoons salt
½ teaspoon paprika

Scald the milk Add the fat, salt, and flour, mix smooth with an equal amount of cold milk Cook five minutes to break up the starch in the flour, stirring constantly to prevent lumping and burning Season and serve This recipe allows about 4 tablespoons of sauce to each pupil It may be used for baked potatoes, creamed potatoes, and creamed vegetables

III. POTATO SOUP (Serves 12)

| | |
|---|---|
| 7 medium-sized potatoes | 2 tablespoons fat |
| 3 cups boiling water | 4 teaspoons salt |
| 1 small onion | 4 tablespoons flour |
| 6 cups or 1½ quarts milk | 1 teaspoon celery salt |

a bit of bayleaf

Peel potatoes, cut in small pieces, and cook till soft in 6 cups boiling salted water (1½ teaspoons salt). Without draining mash the potatoes; add the fat, thinly sliced onion, and flour mixed smooth with equal parts of cold water, and boil five minutes to cook the starch in the flour. Stir constantly to prevent lumping and burning. Add the milk and bring to boiling point. Season and serve.

IV. TOMATO SOUP (Serves 12)

| | |
|---|---|
| 1 quart can tomatoes | ½ cup flour |
| ½ teaspoon soda | 6 cups or 1½ quarts milk |
| ½ teaspoon salt | ¼ teaspoon pepper |
| 1 small onion | ¼ teaspoon celery salt |
| ½ cup fat | bit of bayleaf |

Heat tomatoes and mash well with fork or potato masher. Add soda, onion, salt, fat, and flour mixed with equal amounts of cold water, and boil five minutes to cook starch in flour. Stir constantly to prevent lumping and burning. Scald milk in double boiler and just before serving turn hot tomato mixture gradually into the hot milk, stirring all the time to prevent curdling Season and serve immediately.

V OATMEAL (Serves 12)

2 cups oatmeal—8 cups boiling water—1 teaspoon salt

Bring water and salt to boil in top of double boiler Add oatmeal slowly and boil five minutes directly over fire, stirring constantly to prevent lumping and burning. Set over bottom part of double boiler and cook three hours; ½ cup washed raisins may be added the last half hour of cooking to give variety Serve with warm milk and sugar. Oatmeal cooked in a fireless cooker is delicious

(Note. Measurements are level in these recipes )

**The lunch from home.** Various containers are used for the teacher's and the school-child's lunch. Sometimes it is a box, which should be of odorless material, durable, light, easy to carry, and having means of ventilation. Tin boxes or pails with perforated lids are the best because they can be thoroughly

scalded and aired, as they should be. Fiber boxes are easily soiled and cannot be cleaned Homemade lunch containers can be used and thrown in the stove after using. Baskets may be used although the food dries out quickly and is apt to freeze in cold weather. The lunch must be well wrapped to protect it from dust and insects. The folding lunch box of metal is used quite extensively. It should be well aired daily.

Children can be taught to pack their own lunches, and such instruction can be given at school. Plain paper napkins are almost indispensable The various parts of the lunch should be wrapped in oiled paper; liquid foods should be placed in tightly sealed jars Children should be taught the importance of thoroughly cleansing and airing the lunch container every day.

A well-planned school-lunch box should have one or more foods from each of the following lists:

*Bread sandwiches with:* either American cheese, ground cheese mixed with bacon fat, cottage cheese and peanut butter, cottage cheese and chopped pickles, cold meat in thin slices; peanut butter, baked beans; bacon; bacon and cottage cheese, eggs, hard cooked, chopped, and seasoned, fish made into a paste and seasoned, or lettuce or cress

*Fruit or vegetables* Raw fruit (apples, oranges), cooked fruit in jelly glass, baked apple, prunes; canned fruit, raw carrots; tomatoes, celery; radishes, vegetable salads in glass or jar, potato chips.

*Sweets.* Baked custard, cup cakes; cookies, dates, raisins and nuts, figs, prunes, sweet sandwiches of jam, jelly, marmalade, dates, or prunes.

The following are wholesome, nutritious, well-balanced, and appetizing school lunches from home, but they should be supplemented by one or more good hot dishes prepared at school, particularly during the winter months. The quantities of food in the following lunches may need to be increased, depending upon nutritional requirements of the individual.

*a.* A ham sandwich, a jelly sandwich, an apple, and a small piece of plain cake.

*b.* A cottage cheese sandwich, a brown-bread-and-butter sandwich, an orange, a cookie.

*c* A chicken sandwich, a graham-bread-and-butter sandwich, one-half cup of apple sauce.

*d.* A chopped-egg sandwich, a bread-and-butter sandwich, one-half cup of stewed prunes

*e* A peanut-butter sandwich, a jam sandwich, raisins, a cookie

*f* A chopped-meat sandwich, a bread-and-butter sandwich, one-half cup canned fruit, gingerbread

*g* Sandwiches with sliced tender meat for filling, baked apple, cookies, or a few lumps of sugar

*h* Slices of meat loaf or bean loaf, bread-and-butter sandwiches, stewed fruit, small frosted cake

*i* Crisp rolls, hollowed out and filled with chopped meat or fish, moistened and seasoned, or mixed with salad dressing, orange, apple, a mixture of sliced fruits, or berries, cake

*j* Lettuce or celery sandwiches, one cup custard, jelly sandwiches.

*k* Cottage-cheese and chopped-green-pepper sandwiches, or a pot of cream cheese with bread-and-butter sandwiches, peanut-butter sandwiches, fruit, cake

*l* Hard-boiled eggs, crisp baking-powder biscuits, celery or radishes, brown-sugar or maple-sugar sandwiches

*m* Bottle of milk, thin corn bread and butter, dates, apple

*n.* Raisin or nut bread with butter, cheese, oranges, maple sugar

*o.* Baked-bean-and-lettuce sandwiches, apple sauce, sweet chocolate

**Mealtime management and manners.** To get the full advantage of having the pupils eat together and under the eye of the teacher these points should be observed:

1. The room should be thoroughly aired before lunch is eaten
2. The children should wash their hands before eating
3. The desk should be cleared and a paper napkin or a piece of oilcloth spread for a tablecloth
4. The lunch should be spread on the napkin and the lunch pail or box put under the desk, out of sight.
5. Lunch should be eaten in the right order, dessert last.
6. A fork or spoon should be used to carry the food to the mouth.
7. The children should remain in their seats until all have finished eating This will prevent hasty eating
8. The children should be permitted to drink water with their lunch, but they must not be allowed to swallow their food hurriedly by washing it down with water
9. The children should be taught to eat slowly and quietly Hasty eating causes indigestion and consequent ill health

10. The conversation should be kept pleasant

11. The teacher's manner of eating will be the standard for the table manners of the pupils, as children are very imitative The teacher should prepare her lunch at her desk.

The lunch offers an excellent opportunity to overcome peculiar food habits, as the group spirit allows no personal preferences Through the hot lunch many a child learns to like a nutritious food which he would not touch at home.

Neatness in general appearance, such as clean hands and clean aprons for the cooks, should be encouraged Simple aprons and holders can be made in the sewing class from toweling or flour sacks The best standards of dishwashing should be carefully followed [1]

**An organized lunch hour.**[2] Why not have an organized lunch hour in every rural school? This will require a little extra planning on the part of the teacher, but the results will more than compensate for the time and effort When we consider the rural child's long day away from home, we think of some of the family routine of which he is deprived. Often he goes the entire day without washing his hands He eats a quick lunch, sometimes sitting on damp, chilly ground, or sometimes on the run to the playground Couldn't all teachers do something to make the noonday lunch a more homelike situation? Here are some suggestions

1 Children form in line for washing If the school is large, one pupil may pour the water on each child's hands as he holds them over the washbasin He need not put his hands into the water, thus constant emptying of the dish is unnecessary The water may be poured from a dipper, or, preferably from a teakettle in which it has been heated to about the right temperature. Two pourings are necessary, one before and one after the soap has been used The teacher may use this opportunity to step outside for daily inspection of outbuildings, which is important

2 Another pupil passes out paper towels as children finish washing.

3. A third child places towels or other papers on desks to protect them and to catch any crumbs which may fall

[1] In preparing this chapter the author has borrowed both ideas and language from bulletins issued by the United States and by his own state Three teachers of home economics have furnished useful and usable materials

[2] This plan is used by Mrs Lillian M. Ellis, County Superintendent of Iowa County, Wisconsin.

4 After each child has dried his hands, he takes his lunch box to his seat where he remains standing until the teacher brings her lunch and seats herself at her desk.

5 The children know that they will not be excused until all, or nearly all, have finished eating. This requires about twenty minutes, so all should take time to eat properly. During this period pupils may be encouraged to converse informally. Occasionally special entertainment numbers might be given. Some child may sing the new song learned in the music period, a poem may be read by someone who did it very well in the language class; or a story or some special topic, which was not given in class because of lack of time, could now be presented, if desired and desirable There are also other possibilities which will occur to the thoughtful teacher

6. At the conclusion of lunch and dismissal, each child carefully gathers up the paper from his desk, drops it into the waste basket, and then puts his lunch box away before going to play.

Some children have very light breakfasts and when recess time comes are ready to eat. Train these children to eat an apple or a sandwich rather than cake or other sweet, as they are usually inclined to do.

## REVIEW, TEST, AND PROBLEM EXERCISES

1. Make out a varied list of menus for a whole month of hot lunches for a rural school of twenty pupils, being sure that the dishes are attractive, appetizing, and nutritious

2 Outline a talk which you will give to the mothers at a mothers' meeting to convince them of the advisability of hot lunches in your school.

3 In what ways will the hot lunch help to bring about a closer co-operation between the school and the home? Why is this highly desirable?

4 Name several suitable subjects for conversation while teacher and pupils are eating their dinner together.

5 Tell what the boys can do in promoting the hot lunch enterprise. Can a boy be taught to do any of the work done by the girls? Why should boys learn to do such things?

6. What may some board members say by way of opposition to your hot lunch proposition? Can you convince them that the plan is feasible and the right thing to do?

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# CHAPTER XII

## PARENT AND TEACHER WORKING TOGETHER

**Need for co-operation.** If democracy is to succeed and have increasing meaning and value for the ordinary citizen, our schools must inculcate the principles and promote the practice of co-operation The social aim and method need constant stressing. In the relations which necessarily exist between parent and teacher there is repeated opportunity for manifesting the spirit and the art of co-operation The child is the common interest of both parent and teacher, the welfare of the child should be held up as the constant objective Modern business and industrial life is carried forward successfully only on the basis of co-operation Many men engaged in our great productive, mercantile, and financial enterprises have long understood the value of co-operative methods. The school must make much larger use of the wise systematic co-operative procedures of these business men, if it is to minister to the social and economic demands of our day In rural communities the relative lack of opportunities for social and business contacts, as compared with urban groups, makes for a type of extremely individualistic thinking and acting which is not conducive to community welfare When the individual senses the common need, he is in a better position to lend a hand in promoting common interests Co-operation requires thought and unselfish effort as well as the spirit and the ideal of service. Both parent and teacher need to be actuated by a public or community outlook and aim in which selfish interests are submerged for the good of all.

**The function of the school.** The school is a social institution established for the purpose of carrying forward that additional and necessary work of education which the home cannot under-

take because of its inherent lacks and limitations The school only supplements the work of the home The home comes first; but due to the fact that parents have neither the time nor the ability to educate their children in all ways, the school has come into existence The parent hands the child over to the teacher for a part of the time, but he does not surrender his own prerogatives as parent The wise teacher recognizes the rights of the parent and does not too strenuously insist upon his own personal or teacher rights

The function of the school is to train boys and girls for participating citizenship in a democracy Effective citizenship implies correct ideas, suitable ideals, and necessary habits Boys and girls are to be taught and trained for social efficiency, which means the inculcation and development of attitudes, desires, interests, and appreciations and the acquisition of abilities, skills, and dexterities, as well as the items of knowledge which are usually found in textbooks That knowledge is of course necessary, but habits of effective response to actual problem situations is of far greater importance because of their manifest importance in all effective social activities and relations

It is likewise the function of the school to promote health in all possible ways It should also develop a type of character, or personality, which will be adequate when the individual meets the responsibilities and discharges the duties of social and civic life Further, the school should give the child the fundamental skills and tools of learning, such as power to read and love of good reading, by which he will be able to continue his education throughout life A rural school may also render genuine and valuable service to the older people of the community through the library, through community-center gatherings, and in other similar ways

**The evil of indifference.** Indifference on the part of parents is very common; in fact, it is apparently the rule Such lack of interest, however, is not always the fault of the parents, for many times a poor school and teacher have so discouraged them that they lose the interest which they might otherwise naturally

manifest It has often happened that results which parents had hoped for in their children have not been forthcoming There have been weaknesses and deficiencies in reading, language, arithmetic, or in character education Children often lack both ability and interest in reading; they quite commonly cannot write passable letters, and they cannot be trusted in many if not most cases to add a column of figures correctly. So parents lose heart and blame the school Worst of all, they lose their interest in the school, become indifferent, fail to visit the school, and refuse to co-operate with the teacher.

When parents lose interest, they cease to keep in touch with the teacher, perhaps they take sides with the child against the teacher. Such a situation is unfortunate and damaging, it may have a serious influence upon the discipline of the school Indifference of parents can only work hardship on the school and interfere with its welfare Every effort, then, should be made to overcome such a lack of interest. The teacher can do much by making her work as interesting, effective, and practical as possible The teacher who keeps the home and the parent in mind will often find ways to interest parents Adequate financial support will usually follow interest and moral support, unless there is such a lack of funds as to make this actually impossible.

**The interested parent.** When the parent is interested in the school, the teacher will find her work going forward more easily and more successfully. No effort will meet with greater rewards than that directed to arousing and maintaining a genuine interest on the part of parents When the mother is really concerned about the affairs of the school, she will visit the school of her own accord, not once only, but several times during the year Not only will the interested mother visit the school frequently, she will also seek means to co-operate with the teacher and will attend mothers' meetings and other gatherings at the schoolhouse.

When a father is really concerned about the welfare of the school and desires to have a good school for his own and his

neighbor's children, he will favor adequate taxes; when the annual meeting occurs, he will lend his support to a fair, equitable budget for the ensuing year One of the serious problems in many schools is that of attendance; but when the parent and teacher are thinking and working together, this problem will not be so difficult, for the interested parent will make an effort to have the children in school every day and on time

**Selling education to the public.** The average citizen and taxpayer is not well informed as to school conditions and needs. He simply does not know a great many things which it would be very useful for him to know. Were he better posted concerning the aims and policies of those who manage the schools, he would not be so inclined to criticize; for any reasonable person can be led to see and to understand the great work being done by the public schools and the importance of spending adequate sums of money in order to secure results It is the province of those who administer public education—boards, superintendents, principals, and teachers—to see to it that the patrons, taxpayers, and the public in general are duly informed concerning the various phases of the work of the schools A continuous propaganda of judicious, well-directed advertising of the cause of education and of the schools is greatly needed; it should be carried on systematically and unremittingly

A former county superintendent of Cook County, Illinois, E. J Tobin, now deceased, had much faith in a variety of publicity measures He did not allow the people in the rural districts outside of Chicago to forget the cause of education. He employed educational contests of many kinds, held athletic field meets, and widely advertised rural school graduation exercises in which both old and young could be interested and actually participate. Mr Tobin had a very clearly defined yearly program of publicity which cost some money, but which brought adequate returns in the increased interest and support of taxpayers and parents During the later years of this very aggressive superintendent's long term of office, the radio was used regularly and effectively to broadcast all sorts of useful

information about the rural schools of Cook County. It is quite possible for the rural teacher to have her school issue a monthly or semimonthly school paper, which can be printed on a hectograph. If this paper goes into all of the homes it can be made the means of informing patrons and taxpayers concerning the work and the needs of the school. Much prejudice or indifference is born of ignorance of conditions and needs; the obvious remedy is honest broadcasting of facts. Most country newspapers are glad to carry school items once each week. A capable rural teacher can make profitable use of such an opportunity. Both school papers and the rural press are often used with much satisfaction, interest, and profit. School exhibits or a school fair once or twice a year are also good means of advertising the school; this method is becoming increasingly common and effective. Mothers' clubs, parent-teacher associations, and other organizations are valuable agencies for letting parents know of the objectives and the work of the schools.

**Getting money for the schools.** One city superintendent of schools who was exceptionally successful in securing co-operation and money for school purposes, in whose city a magnificent million-dollar high school had been erected, was quite inclined to stress moral support rather than merely financial. He implied that money would be forthcoming if people could be led to understand the needs of the schools. This superintendent was a first-rate advertiser; he kept the schools constantly before the public. The people were not allowed to forget, ignore, or belittle the cause of education or its significance in this progressive city where the managerial form of municipal government was and is today markedly successful. Money is needed to operate schools as they should be operated; it frequently happens that all too little money is spent for education in rural districts. Many times not enough taxes are levied at the annual meeting; a spirit of parsimony is all too evident. A program of unwise, skimping economy robs the children of their educational heritage. Here is a definite opportunity for teacher leadership and for a wise campaign of management on the part of the

county superintendent who is in a strategic position to exert a real influence for good in the expenditure of public funds if he has the right personality.

Undoubtedly most of the money to operate the schools should be paid in legitimate taxes, levied and raised through the usual channels However, teachers are often able to get funds to buy pictures, a piano, a flag, a phonograph and records, or other equipment of similar nature through box socials and entertainments of various sorts Desks, chairs, globes, maps, and the like should not, in the opinion of the writer, be bought in this way, however People will have the kind of schools they want, when the need is adequately realized, the money will be raised It is the teacher's function to disseminate correct ideas, to suggest ideals of life, and to help mold public opinion

**Organizations of parents and teachers.** The outstanding and the most influential association of parents and teachers is the National Congress of Parents and Teachers with headquarters at 1201 Sixteenth St , N W , Washington, D C , which has an affiliated congress in every state of the union Every rural school district in the United States should, if social and economic conditions make it possible, have a local organization officially affiliated with both the state and the national congresses.

(*a*) *The P T A movement* The National Congress of Parents and Teachers was organized February 17, 1897, as the National Congress of Mothers The group was led by Mrs Theodore W Birney and Mrs Phoebe A Hearst, who are recognized as the founders of the organization The original aim of the Congress of Mothers was to organize a greatly needed and desirable control of conditions outside of the home in order to bring about a more effective co-operation of the influences that bear on childhood in home, school, church, and state The first National Congress of Mothers met in 1897 in Washington, D C State congresses have been organized from time to time until now all states are represented Hawaii, District of Columbia, and Alaska are now included The state branch forms a connecting link between the local units and the National Congress;

it spreads the parent-teacher idea throughout the state. The membership of this great association has increased until at the present time it totals upwards of 2,000,000 mothers, fathers, and teachers

(b) *Tribute of the N. E. A.* In 1928 the National Education Association included the following in the resolutions adopted at the summer meeting in July:

No greater movement in the field of education has been fostered during the last quarter of a century than the organization of parent-teacher associations. This movement has for its purpose the welfare of children It has held steadfastly to this high endeavor and has become one of the most efficient agencies in the promotion of all activities which contribute to the successful training of the child in its relation to the home, school, church, and state. In every commonwealth it exerts much influence in the field of the curriculum and in the assumption of a proper attitude toward extra curriculum subjects Without its influence there would have been less progress in the securing of adequate funds for buildings, equipment, and maintenance of the public schools The social intercourse of parents and teachers contributes to a better understanding and appreciation of child nature and brings about united action in every community, resulting in democracy in education. The National Education Association commends this great organization for the work already accomplished and assures its co-operation in all efforts to promote a closer relationship between the home and the school.

(c) *General purposes of the Congress*

To promote child welfare in home, school, church, and community; to raise the standards of home life, to secure more adequate laws for the care and protection of women and children.

To bring into closer relation the home and the school, that parents and teachers may co-operate intelligently in the training of the child; and to develop between educators and the general public such united efforts as will secure for every child the highest advantages in physical, mental, moral, and spiritual education.—From Article II of the By-Laws.

(d) *Why organize a P T A.* It may be that some school districts are so small and weak that a standard state-national

affiliated local seems impossible. However, the effort should be made, some community club should be formed, in any case. The P T A, if rightly conducted, will be of decided value to both school and home; children and their parents will be benefited. Such an organization is needed to develop a wholesome interest and the effective spirit and habit of co-operation. School improvements must be backed by the necessary public opinion of the community. The P T. A aids in promoting a healthy public sentiment favorable to better education. The P. T. A meetings at the school building, which is the property of the taxpayers, afford the best sort of an opportunity to unite the people in a movement of educational and community betterment Little or no progress can be made without co-operative effort backed by a good community spirit The P. T. A. is the best social agency yet devised to secure these objectives.

The parent-teacher association forms a home and school partnership and provides the necessary medium for establishing a unity in educational standards. . . It enables parents, teachers, and others who are interested in the well being of young people to declare their interdependence and to unite their forces in an intelligent effort to secure better homes, better schools, and better communities for better children.

(e) *Objectives of the local P. T. A* [1]

1. To form a partnership of home and school.
2. To establish co-operation among parents.
3. To promote an understanding of school standards and activities.
4. To understand, interpret, and support the school system.
5. To develop programs and study courses on child welfare.
6. To train for the calling of parenthood.
7. To develop activities constructive, preventive, protective.
8. To prevent mistakes and misunderstandings.
9. To promote child-welfare legislation.
10. To secure co-operation with other organizations
11. To develop informed members and efficient leaders.
12. To build a united community, state, and nation.

[1] In *Parent-Teacher Manual*

(*f*) *Getting started right* Some years ago a parent-teacher association was organized one evening in a rural school; the organization is still in a thriving condition The program for the evening began at eight o'clock There was a good representation from nearly all of the homes of the district because the meeting had been well advertised and invitations sent to everybody Moreover, every child had a place on the program All the children of the school were there, they presented a program of singing and speaking under the teacher's direction Then the rest of the evening was given over to the organization of the club and the serving of refreshments at the close The speaker of the evening gave a talk in which he set forth the values of community-center activities and stressed the need for close co-operation between school and home After this preliminary talk the people were ready to effect an organization. For this purpose a constitution had been procured and a copy passed to every adult in the audience This served as a guide in the selection of officers and in the naming of the necessary committees. One of the difficulties was to secure the proper persons to serve in the various capacities, people were somewhat timid and slow in making nominations However, the leader tried to make the situation as easy as possible by repeated explanations, finally the officers were elected and the needful machinery was effected and set in motion This local association has been the chief agency for civic, social, and educational advancement in that district for a long period of years.

(*g*) *Types of activities and benefits.* Parent-teacher associations have engaged in a great many different kinds of work and have carried out programs of infinite variety, depending upon the conditions and needs of the community as well as on the social and educational qualifications of the members In the national *Handbook* the following tests of a good program are given:

1. Is co-operation of the home and school developed?
2. Are local needs discovered and plans made for meeting them?

3. Do the members participate in the program?
4 Is the study and observation of children promoted?
5 Is the program adapted to local conditions?
6 Does the program lead to desirable results?
7 Is home life enriched?
8 Is school life better understood?
9 Is community life improved?
10 Does the program result in constructive activities in the association?

In 1926 a campaign of organized parent co-operation was conducted in North Dakota under the auspices of the National Congress of Parents and Teachers and at the expense of the national organization This intensive drive was productive of improvements of the most pronounced character Within six months the 10-per-cent quota for the first year of a five-year program had been passed by every one of the 53 counties of the state, one county had the distinction of 100-per-cent organization of its schools In April, 1926, 31 per cent of the schools had secured parent-teacher co-operation These statements are taken, with some modifications, from the Federal Bulletin of 1927, No 11, written by the national president, Mrs. Margaretta N Reeve Among the thirty-three benefits listed are the following

1 Terms lengthened—attendance improved.
2 New buildings—schools standardized
3 Library books and pictures purchased
4 Warm noon lunch served
5 Milk provided for underweight children.
6 Dental clinics established
7 Movies censored and supervised
8 Health crusades sponsored.
9 Standards of home life raised
10 Friction in community lessened
11 Friendly relationships established.
12 Moral standards improved.
13 Increased visitation of schools
14 As a whole, the parent-teacher association acts as a socializing and educational project in any community

(h) *Suggested by-laws.*[1]

*Article I.—Name.* The name of this association shall be the ______ Parent-Teacher Association, of ______ County, a local unit of the (state) branch of the National Congress of Parents and Teachers.

*Article II.—Object* The object of this association shall be to promote child welfare in home, school, church, and community.

*Article III.—Policies.* Section 1 The policies of this association shall conform to the policies of the state and National Congress of Parents and Teachers

Section 2. The association shall be noncommercial, nonsectarian, and nonpartisan Neither the name of the association nor the names of its officers in their official capacities shall be used in the endorsement of any political candidate or commercial enterprise

Section 3. This association shall not seek to control the activities of the school board and teachers

*Article IV.—Membership and Dues* Section 1. Anyone interested in the purpose of this association may become an active member upon the payment of dues as prescribed in Section 2

Section 2. The annual dues for membership in this association shall be ______ cents, of which ______ cents shall be sent by the local treasurer to the treasurer of the state branch for the state and national portions of dues. (Note. National dues are five cents per member.)

*Article V.—Officers and Their Election.* Section 1 The officers of this association shall be a president, vice-president, secretary, and treasurer, elected annually.

Section 2. The nominating committee shall report at the meeting previous to the last meeting of the year, the name of a candidate for each office. Additional nominations may be made from the floor

Section 3 A vacancy occurring in an office shall be filled by the executive committee at the next regular meeting.

*Article VI.—Committees* Section 1 The executive committee shall consist of the officers of the association and a teacher, if no one of the offices is held by a teacher Its duties shall be to transact necessary business between association meetings, to advise with any of the

[1] These by-laws are found in a bulletin prepared by William McKinley Robinson, National Chairman, Rural Service, published in 1934 by National Congress of Parents and Teachers, and are printed here by permission The title of the bulletin is *The Rural P. T A.—Suggestions for Conducting a Parent-Teacher Association.*

officers or committee chairmen, and to transact such other business as may be referred to it by the association.

Section 2 The president shall appoint such committees as are required to promote the object and interests of the association

Section 3 The president shall be ex officio a member of all committees except the nominating committee.

*Article VII.—Meetings* Section 1. A regular meeting of this association shall be held once each month of the school year unless otherwise decided by the executive committee.

Section 2. The last regular meeting of the school year shall be the annual meeting at which time annual reports shall be made and the officers for the new year installed

Section 3 Special meetings of the association may be called by the executive committee

Section 4. Five members shall constitute a quorum if the membership is 20 or under. If over 20, one fifth of the membership shall constitute a quorum.

*Article VIII.—Amendments.* The by-laws may be amended at any regular meeting of the association by a two-thirds vote of the members present, provided the proposed amendment has been submitted at a previous regular meeting

Every rural teacher should send to the state or the national congress for a copy of Mr Robinson's bulletin

(*i*) *Character of the programs.* In a 150-page bulletin, entitled *Rural Education Looking Forward,* issued by the Nebraska State Department of Education [1] in June, 1933, the following statements are found on page 107.

The meetings of the Rural Parent-Teacher Association should, in addition to the short business session, consist of three parts, namely, an entertaining program mainly in charge of adults and consisting of music, readings, playlets by adults, school demonstrations by pupils, and community singing, the next part of the program should be constructive and should include a discussion pertaining to the welfare of the child, the last part of the program is a social hour including community games and refreshments. All meetings should be thoughtfully planned and carefully carried out with the welfare of the child as a central thought The entertaining part of the program and social hour is very important and should be considered as an opportunity to strengthen and enlarge neighborhood and community joy and to de-

[1] By courteous permission of the Nebraska State Department of Education

velop leadership However, the discussion part of the program is a very important reason for the Rural Parent-Teacher Association.

Then follows mention of the various improvements which have resulted from the discussions by adults These are similar to the benefits listed above The concluding sentence is significant. "Best of all, however, is the vital interest that has been secured on the part of patrons in the school work that the children are doing and the kindly co-operation that exists between parents and teachers "

Miss Ellen C Lombard, associate specialist in parent education, Federal Office of Education, in Bulletin No 11, 1927, says that "The influence of the parent-teacher association movement depends upon three main factors Leadership, the quality of the programs offered at the meetings, and the efficiency of the work of the committees "

(*j*) *Suggested topics for meetings* (1) Why parents should attend the annual school meeting (2) How to honor the flag. (3) Recreation in home and community (4) Standards for rural schools (5) Thrift education (6) Building character through reading (7) Preventing fires on the farm (8) Forming better study habits (9) School sanitation (10) Overcoming tardiness and irregularity (11) Mothers' meetings (12) Co-operation and the hot lunch (13) The school as a community center (14) Parents who help the teacher (15) Undernourished children (16) Playground supervision (17) Balanced dietaries for the growing children (18) Movies, the home, and the school. (19) Influence of good stories on the child's character. (20) Importance of good reading matter (21) Co-operation of teacher and parents (22) Games to interest children (23) Value of music in the home (24) Who are good mothers and fathers? (25) Physical needs of children in home and school

This list of topics is suggestive only. There is almost no end to the number of interesting and useful subjects which may be considered The teacher will secure valuable information by writing to the United States Office of Education, Washington, D. C The best way is to prepare all of the programs for the

year in advance, naming all the topics, the persons who will discuss them, the dates on which they will appear, and many suggestions for working up the topics for talks and discussions. See the Nebraska bulletin referred to above This should be found among the references of the training school

(k) *Where to get information and help* It would be an excellent thing for every teacher to write to the National Congress of Parents and Teachers, 1201 Sixteenth Street, Northwest, Washington, D C Send a letter, not a postcard, for a complete list of all publications Enclose thirty cents in stamps for a copy of the *Parent-Teacher Manual* which is a very useful source of information Each teacher should also get in touch with her own state congress of parents and teachers Find out about the officers, the meetings, the publications Get a copy of the official publication of the National Congress known as *The National Parent-Teacher Magazine* Teachers need a great deal of general information and background of knowledge It pays to keep posted and it pays to know where to get what you need

**Reciprocal relationships.** The parent is the child's first teacher, when the child is sent to school the parent reserves some of the rights of a teacher and all of the rights of a parent The teacher does well to recognize the rights of parent and home. There is no sharp dividing line between the jurisdiction and prerogatives of parents and teacher The main things are a good spirit and the right purpose on the part of both parties. Quite naturally almost any parent is anxious to have his boy or girl do as well as possible in school, but he does not turn the child over to the school without some misgivings and without reserving the privilege of controlling the situation to some extent Every wise teacher takes the parent into account

Although the teacher does not supersede the parent in all ways, still he does possess quite clearly defined rights and duties. The teacher, not the parent, must do the teaching The teacher determines subject matter and its method of presentation. Moreover, the teacher represents the state and is thus in duty

bound to carry out the course of study and the directions of superior school officials As far as the school may reach, the teacher has charge of the whole child—body, mind, and spirit. It is the teacher's duty to take note of and to plan for physical health, mental training, and moral education She is *in loco parentis*, and as such, she may administer proper punishments. The teacher is both the agent of the state and the representative of the parent and the home When it is a question of concurrent jurisdiction, as regards, for example, the conduct of children going to and from school, the parent and teacher share in authority There should be a complete understanding and a spirit of tolerance and good will. The teacher should seek opportunities to get acquainted with parents before trouble arises A basis of friendly acquaintance and association will do much to help solve the hardest problem.

**Co-operation in teaching.** In the actual work of teaching there is ample opportunity for teacher and parent to co-operate The best teachers are those who stress the life of the community and who seek means for connecting the work of the school with the experiences of the people of the district.

In arithmetic, farm problems can be used much more than is common The children should take actual measurements and from these compute areas, contents, and costs Let the pupils measure bins, granaries, haystacks, and silos Give them practice in estimating After an estimate has been made, the actual contents may be computed. Estimate acres in the garden, the orchard, and the pasture; then find the exact areas Compute the amount and the cost of plastering and painting for real buildings and rooms. Find the amounts of actual bills and teach a simple form of keeping accounts In this way children will not only be taught arithmetic, but incidentally they will acquire much useful information that is absolutely necessary in order to work out the ordinary everyday problems of life This information will also do much to develop in the children that faculty known as common sense

In civics teach the primary election, the general election, the

town meeting, and the court sessions, when these are of interest in the community New laws that are enacted from time to time dealing with important community interests should be taken up and discussed

The history of the school district is a useful and interesting topic. As a rule, however, it cannot be studied until the teacher has been in the district for some time and become somewhat acquainted with the people. The following are some of the questions that may be used by the teacher for the children to ask at home. Who were some of the first settlers in this community? When did they come? Where did they settle? What was the condition of the country at that time? Where was the first clearing made? What kind of buildings did the first settlers erect? Are any of those old buildings still standing? Where was the first schoolhouse built? What kind of a building was it? Is it still in existence? What were the first churches and public buildings? Are there any former soldiers in the district? Who? In what war did they take part? Were they in any battles? If so, where? Were any of them wounded? From what country or states did the people in this community come? Name the various countries or states represented, such as Germany, Ireland, Norway, New England, New York State. The pupils may make a map, and indicate by different marks or colors the various nationalities that make up the district

The opportunities for concrete teaching and for the school and home to work together are abundantly exemplified in local or community geography In order to teach the geography of the district, the teacher must do some real exploring on her own account One of the best means is for the teacher and pupils to make a map of the district on as large a scale as practicable. Do not hurry this map, but take several weeks or months, if necessary It should be done as accurately as possible, showing the roads, areas of farms and fields, and the location of the schoolhouse, quarry, creamery, town hall, and large wooded tracts, if any. Pupils will secure this needed information at home from day to day Locate the church, the village, the homes, the resi-

dences of school and town officers. The map should be done carefully to scale. After the first map is made by teacher and pupils, each upper-grade pupil should make one for which he or she may receive credit in the county examination

In the work in agriculture and nature study there is obviously a rich field for co-operation of home and school. We have only to mention such subjects as birds, weeds, corn, insects, grains, farm animals, the silo, to see that here is a type of subject matter which lends itself to united effort One of the most profitable undertakings of a rural teacher and her upper grade pupils is a complete social and economic survey of the school district Directions for making such a survey may be secured by writing to the Office of Education, Washington, D. C, or perhaps to the state department of education or to the state university

**Why mothers' meetings?** The regular meeting of a thriving mothers' club is one of the best enterprises that any rural teacher can promote This club should meet at least monthly, and at the schoolhouse several times during the year The meetings may very well extend from two to four o'clock The program should usually consist of three parts. *first*, the regular class exercises for at least 75 minutes, some special class work may also be carried out, *second*, a simple program of speaking and singing for about 20 minutes in which all children participate; *third*, a social quarter-hour or more, during which light refreshments are served by the teacher and a committee of pupils If the teacher wishes to speak very briefly to the mothers, she may do so just before the social period Work done by pupils should be posted so the mothers can inspect it as they wish Everyone should be on his or her best behavior, of course If teacher and pupils acquit themselves with credit, the general effect will be wholesome, indeed The entire school should make very careful preparation for this mothers' meeting Here are some good reasons for such meetings

1 They furnish a pleasing opportunity for bringing the parents, or mothers at any rate, to the school, this is of first importance

2 They bring teacher and parents into closer touch and thus furnish the conditions for co-operation. Such co-operation is the basis for any successful school

3 Through contact with the parents the teacher gets a more helpful and a more sympathetic attitude toward her pupils Sympathetic helpfulness appeals to the mother, and she will be ready to back the teacher in her program for pupil betterment

4 These meetings give the teacher an opportunity to explain any school matter or to present a school problem to a group of interested and usually responsive persons

5 The teacher on such an occasion has a good chance to show what is needed in the way of improvements—furniture, books, or other equipment of any sort

6 These meetings emphasize the important and ever-present need that the school and the home work together for the good of the child

7 During such gatherings the parents often see more plainly the difficulties under which their teacher works, they are more inclined to give her the needful support.

8. Through these meetings the parents come to realize more fully the meaning of education; they are sure to acquire an interest in the welfare of their school as an agency for promoting the cause of education Not all will respond equally, but there will be an increasing number who will come to realize the situation more and more completely

9 These meetings have frequently been the means of clearing up misunderstandings which, if allowed to go on, would tend to interfere with the efficiency of the teacher and therefore of her school

10 Pupils always tend to take more interest and to do better work if they see that their mothers and their teacher are working in harmony for their good.

## REVIEW, TEST, AND PROBLEM EXERCISES

1 List all the means you can think of by which a rural teacher can acquaint her patrons with the work of her school and get them interested in the general cause of education.

2 Write out a dozen directions and suggestions for carrying out a successful box social conducted for the purpose of raising money to purchase a radio

3 If you were to organize a parent-teacher association in your district, what initial steps would be necessary? State the first five things you would need to do, in order of time

4 With the co-operation of the pupils and of the parents, make a list of the birds, trees, weeds, and wild animals found in your district

5. Indicate thirty to fifty items which should be found in an economic and social survey of the district.

6 State the values of and the objections to a system of school credits for home work. In your opinion is the idea a sound one?

## REFERENCES FOR THE TEACHER'S READING AND STUDY

Send to The National Congress of Parents and Teachers, 1201 Sixteenth Street, Northwest, Washington, D C, for the *Parent-Teacher Manual* (1935). Price 35¢ Ask for the price-list of publications.

Read *Rural School Management* by Eells, Moeller, and Swain, Chapter III

Read Wilkinson's *Rural School Management*, Chapter II.

Send to Office of Education, Washington, D C, for price-list of bulletins on co-operation of home and school, community centers, and related subjects

Pittman's *Successful Teaching in Rural Schools* and Kirkpatrick's *The Rural School from Within* give many interesting, suggestive, and helpful discussions

Write to the State Department of Public Instruction, Lincoln, Nebraska, for the price of a very useful 150-page bulletin entitled *Rural Education Looking Forward*.

## CHAPTER XIII

## GUIDANCE IN PARTICIPATING CITIZENSHIP

**Purpose of chapter.** This chapter is chiefly devoted to a consideration of the school society because such an organization affords the needful occasion and machinery for important participating activities The regular school-society programs, including parliamentary practice, should be as much a part of the school work as any activity of the curriculum

There are many boys' and girls' and young people's organizations functioning in the various states. Some of these have a state-wide membership; others are limited to the county, the town, or the local district These clubs vary in purpose and character Some are purely social and recreative, some relate to farm projects, some have to do with home or household economics, some have literary features, and so on to great length In many states, the state department of education or the state agricultural college or other state agency has sponsored and aided clubs for young people In many instances private organizations have rendered valuable assistance in many ways At the present time the 4-H Clubs are by far the strongest and most influential of all clubs whose activities center around the farm and the farm home These clubs are for both boys and girls, a brief discussion of them is found near the close of the chapter Other organizations rendering a most valuable service in rural communities are the Y. M C. A, Boy Scouts, Girl Scouts, Y W C A (Girl Reserves), Campfire Girls, Knighthood of Youth, Young Citizens League, Thrift Clubs, and Junior Red Cross.

In all of these associations involving united effort we find a need for many of the skills which are acquired in an active school society. In this chapter, therefore, the emphasis will

be upon the development of such skills. Owing to lack of space, it is impossible to consider more than the 4-H Clubs in addition to the school society At the present time any rural teacher who so desires can find information on every phase of social-civic training for boys and girls

**Need for training in a democracy.** The school society, or the literary society, as it is sometimes called, has been given much attention in the rural schools of most states for many years. Certainly no type of work is of greater practical value to the boys and girls who must manage affairs of government in years to come. It is, indeed, difficult to overestimate the importance of training pupils in the procedures for conducting a public meeting, there is general ignorance on this subject among our adult population Relatively few know how to act as chairman of a meeting or how to write the secretary's minutes in proper form. The only way by which boys and girls can ever know these things is by direct instruction and practice As a case in point, the way in which some of our annual school meetings are conducted is not a credit to our citizenship The teacher will do well to keep in mind these and other actual conditions which confront our young people when they grow to manhood and womanhood, and to prepare them specifically for the particular duties they will need to discharge as active, participating citizens of the community Some of the pupils will one day serve as school clerks or town clerks, chairmen of the town boards, town treasurers, members of the county board, or in similar official capacities The school should consciously and specifically prepare them for these duties of citizenship The school society is an important agency for such preparatory instruction and guidance.

**Significant objectives.** The school society will serve several useful purposes; among these are the following· (1) to give adequate and specific training in the organization and management of a society; (2) to instruct and train pupils carefully in the particular, definite forms of good parliamentary usage, (3) to afford suitable occasions for the regular presentation of

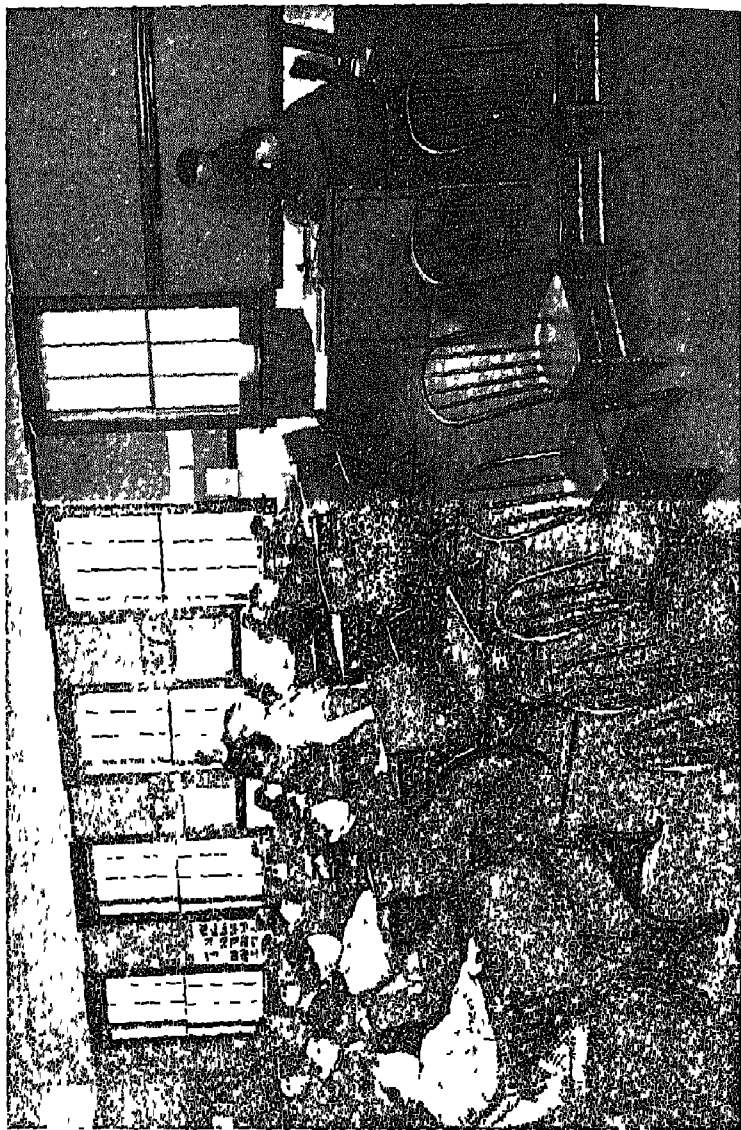
well-prepared rhetorical or literary exercises, (4) to furnish the machinery, especially through committees, for co-operation between teacher and pupils in carrying on the regular work of the school and in such extracurricular activities as may promote the social and civic betterment of the children, (5) to give teacher and pupils a ready-to-hand organization for presenting public programs of various sorts at mothers' meetings and community-center gatherings; (6) to give means for correlation with the work in civics or civil government by affording opportunity for training pupils directly in the functions of the annual school meeting, the town meeting, and the meeting of the county board

In this way, also, boys and girls may be taught how to keep the district clerk's record book, the treasurer's accounts, and other official records It may be that the clerk's records or the treasurer's accounts in many districts will not be kept as they should be In that case perhaps the teacher can secure the co-operation of the county superintendent in finding the correct form The data for the records, at least, can be secured from the proper officials

**A constitution and bylaws.** The society should have a workable constitution and set of bylaws. These can be found in many sources The particular form adopted by the school should contain all that is necessary in order to provide for the needs of the school and no more In this connection children should be taught the need for system, rules, and regulations. The pupils should know their constitution; it should be posted on the bulletin board After a constitution and bylaws are adopted, teacher and pupils should follow them In this work take nothing for granted, but teach and train in necessary details.

The following constitution is so simple and usable that the author feels it will serve for many rural schools in various parts of the country

*Preamble*

We, the pupils attending school in District No , of the town of . County, State of , in order to be of

The school society in session

the greatest possible service to our country, state, and community, to advance the interests of our school, and to afford added opportunities for our own educational development, especially in training for the conduct of public meetings, do form ourselves into a school society and adopt for our guidance this Constitution

*Article I—Name*

The name of this organization shall be the Public School Society of Dist No , Town of , County, State of

*Article II—Objects*

The objects of this Society shall be 1. To afford opportunities for development through participation in business meetings, parliamentary practice, preparation of programs, and the like 2 To enable us as pupils to work better as a group in building up our school and our community 3. To teach and train the pupils of this school to work as effectively as possible in co-operating with the teacher, the board, and others of the school and community

*Article III—Members*

1 Any person who attends this school or who intends to attend the school during the year shall become a member of this Society by signing the Constitution, provided that no person shall be enrolled as a member while attending another school 2 The teacher shall be a member of the Society 3 Graduates from this school during the past two years shall be honorary members of the Society.

*Article IV—Officers*

1. The officers of this Society shall be a President, a Vice President, a Secretary, and a Treasurer With the exception of the Treasurer, they shall be elected for a period of . months (weeks), and shall hold their offices until their successors are elected and qualified The election shall be by ballot 2 The President shall preside at all meetings and perform all other duties usually devolving upon such an officer 3 The Vice President shall perform the duties of the President when the latter is absent 4 The Secretary shall keep records of all meetings, carry on all correspondence of the Society, and perform other duties pertaining to the office 5 The teacher shall be the ex-officio Treasurer of the Society The Treasurer shall keep all the funds of the Society and pay out money upon the order of the Secretary, countersigned by the President 6 The officers of the Society shall constitute the Executive Committee. The Executive Committee shall have charge

of the general management of the Society and of any special work delegated to it and not referred to any special committee. The Executive Committee shall also appoint all other committees when ordered to do so by the Society 7 Committees to carry on special work in the Society shall be appointed at any time during the year when it may be found necessary 8 Vacancies in any of the offices, except treasurer, shall be filled by special election at any regular meeting. Vacancies on committees shall be filled by the Executive Committee.

*Article V—Meetings*

1 This Society shall hold regular meetings every Friday afternoon after recess Special meetings may be called at any time by the Executive Committee (Adapt to conditions ) 2 One third of the members of the Society shall constitute a quorum to do business

*Article VI—Dues*

(*a*) There shall be no regular dues, or (*b*) The dues of this Society shall be cents per .

*Article VII—Amendments*

An amendment to this Constitution shall be proposed in writing and read at the regular meeting of the Society It shall then lie on the table until the next regular meeting If carried at that meeting by a majority of all the active members, it shall become a part of this Constitution.

*Bylaws*

1. This Society shall be governed by Robert's Rules of Order

2 The order of procedure at the meetings shall be as follows *a* Call to order, *b* Reading of minutes, and action thereon, *c* Reports of standing committees, *d* Reports of special committees, *e*. Communications, with action thereon, *f* Unfinished business, *g* New business; *h* Program, *i*. Further business, if any, *j*. Adjournment

**Suggestions for programs.** The school society affords the means for two sorts of program activities—the literary program of recitations and singing or other music, and the program which provides opportunity for parliamentary practice and for direct training in the duties of citizenship The teacher should strive not to neglect either phase or to overemphasize either kind of program. Every week the children should get some

practice in public speaking, but likewise some practice in conducting a public meeting There must be specific instruction in parliamentary practice and direct training in actually going through the procedures

The activities of the school society that naturally correlate with the work in civics are important Some of these will deal with parliamentary usage, some will include instruction and training in the duties of various public officials, particularly those of the local community The teacher may be able to secure the co-operation of the school clerk, the town treasurer, or other officers, in doing what is here suggested The chief error may be that the teacher does not work with concrete cases This program is not theoretical, on the contrary, it is practical If the teacher does not know, she should take the necessary steps to find out by asking those who do know, or she should carefully study a good book on parliamentary procedures

Have talks on the kinds of motions, then have the children write out motions and see that they are properly presented Have amendments written out, possibly an amendment to a first amendment The latter is the parliamentary limit Then show the chairman exactly how to state the needed motions All of this work is in the nature of a class exercise Make a regular weekly business of it Take plenty of time to do it right. You cannot use school time in a more profitable way

What of the literary exercises, the observance of various holidays, and the like? Here is a large field In the first place the teacher should look ahead a year and set down in her notebook the various special-day programs which it will be necessary for her to present These special occasions include the observance of the birthdays of noted people who have achieved fame in various fields of human endeavor—authors, famous women, inventors, statesmen, and presidents See list in the Hall of Fame The teacher will no doubt wish to observe Thanksgiving, Christmas, Arbor and Bird Days, Memorial Day, Armistice Day, and she will have a patriotic Washington-Lincoln program

**Starting the work.** 1 Have pupils seated as conveniently as possible

2 Tell them that business is brought before an assembly by a motion or by the presentation of a communication

3 Teach them how to make motions A person must rise, address the chair by saying, "Mr Chairman" The chairman "recognizes" the member by speaking his name, thus "giving him the floor." When a member has been recognized he makes the motion, saying, "I move that," etc, or "I make a motion that," etc

4 The next step is to have the motion seconded. This can be done by any member without rising and without addressing the chair

5 The chairman then states the question by saying, "It is moved and seconded," etc, it can then be discussed After discussion it is put to a vote One form is the following "All in favor say *aye,* all opposed, *no* The ayes have it, and the motion is carried"—or as the outcome may be

6 After this instruction has been given, the children should be given considerable practice in making motions The older ones should also be given opportunity to act as chairman and to put the motions

**Illustrative procedure** For some years the following illustration of actual society practice was printed in a course of study for rural teachers It is reproduced here in order that teachers and pupils may get the form of words and the different ways of handling motions Mr C is the chairman and Mr S. is the secretary

Mr A. (rising)—Mr Chairman

Mr C—Mr A

Mr A—I make a motion that this Society have a Fourth of July picnic.

Mr B (without rising)—I second the motion.

Mr. C—The motion has been made and seconded that this society have a Fourth of July picnic. Are there any remarks?

Mr M—I have no objections to the picnic, but we have plenty of time to consider this matter, as there are some things which must be

considered before adjournment, I move that this question be laid on the table

Mr. O —I second the motion

Mr C —It has been moved that the question relating to the Fourth of July picnic be laid on the table. (Undebatable) All in favor say *aye*, opposed, *no* The ayes have it. Motion is laid on the table

Mr Y —Mr Chairman

Mr C —Mr Y.

Mr Y —It is necessary for us to decide in the early part of this session whether we shall have Mr D. or Mr B deliver the address at our meeting next week I therefore make the motion that we select Mr D as our speaker

Mr A —I second the motion

Mr. C —It has been moved and seconded, *etc* Any remarks? (Here followed a discussion which became very prolonged and it was getting near the time when a decision had to be taken )

Mr X —Mr Chairman

Mr C —Mr X

Mr X —I call for the previous question.

Mr M —I second the call

Mr C —The previous question has been called for. As many as are in favor of ordering the previous question on the main motion will rise; all opposed rise, (18 votes for, 6 against); the motion is carried (two-thirds vote) All in favor of selecting Mr D as our speaker will say *aye*, opposed, *no* Motion carried (main question)

Mr L —Mr Chairman

Mr C —Mr L

Mr L —I move that Mr O be instructed to communicate with Mr D at once by phone so that we may know definitely if he is available

Mr. M —I second the motion.

Mr C —It has been, *etc.* Any remarks? . All in favor say *aye;* opposed, *no.* Motion carried. Mr O is hereby instructed to communicate with Mr D and report the information to the meeting (Mr O leaves )

Mr R.—Mr Chairman.

Mr. C —Mr R.

Mr R —I move that a committee of three be appointed to make the special arrangements needed for our next meeting

Mr S —I second the motion

Mr C —It has been, *etc.* Any remarks?

Mr. A —Mr. C.

Mr. C —Mr A.

Mr. A —I move to amend the motion by substituting *five* for *three.*

Mr N —I second the amendment

Mr C —The motion has been amended, *etc* Any remarks?

Mr T —I believe that it is not right to expect only five to do all the work connected with this meeting Let us all help Therefore, I move to amend the amendment by giving the five the right to draft as many members as may be needed to help them.

Mr. U —I second the last amendment

Mr C —The amendment has been amended, *etc* Any remarks? (After a few members had spoken the vote was put) We shall first vote on the last amendment All who are in favor of, *etc*, say *aye,* opposed, *no* Amendment carried. We shall now vote on the first amendment as amended All in favor of substituting five for three and giving them the power, *etc*, say *aye,* opposed, *no* The amendment as amended is carried We shall now vote on the original motion as amended All who are in favor of, *etc.*, say *aye,* opposed, *no* The original motion as amended is carried.

Mr F.—Mr C.

Mr. C —Mr F.

Mr F —I move that the Society have no meetings during the summer months

Mr Z —I second the motion

Mr C —It has been, *etc* Any remarks?

Mr. M —I move that the question be postponed indefinitely

Mr. S —I second the motion

Mr C —It has been moved, *etc* Any remarks? (Several take part in discussion) All in favor of indefinite postponement of this question say *aye,* opposed, *no* Carried

Mr F —I call for a division of the house

Mr C —A division is called for, those in favor will rise Those opposed will rise The motion is carried by a vote of 12 to 11.

*Recess*

Mr C.—The meeting will come to order.

Mr O —Mr C.

Mr. C —Mr. O

Mr. O —I learned from Mr. D. that it is impossible for him to come to our next meeting as he has another engagement Therefore, I move that we reconsider the vote on the motion regarding the choice of speakers

Mr S.—I second the motion.

Mr C —It has been moved, *etc.* Any remarks?

Mr A —Mr. C.

Mr. C—Mr A

Mr A—I rise for information Did the gentleman who made the motion vote on the prevailing side?

Mr C.—He did If there are no more remarks we shall vote on the question. All in favor say *aye*, opposed, *no* Motion is carried The question regarding our speaker is now open for discussion

Mr M—Mr C

Mr C—Mr M.

Mr M—I move to amend the motion by substituting Mr. E for Mr. D.

Mr N—I second the amendment

Mr C—An amendment has been made to substitute Mr. E for Mr D Any remarks? . . All in favor of the amendment say *aye*, opposed, *no* Amendment carried. We shall now vote on the original motion as amended. All in favor say *aye*, opposed, *no* Carried

Mr A—Mr C

Mr C.—Mr A.

Mr A—I make a motion that we have no meetings during the summer months

Mr C—The gentleman is out of order That motion has been made before during the session and it was postponed indefinitely

Mr I.—Mr C

Mr C—Mr I

Mr I—I move that the question of having a Fourth of July picnic be taken from the table

Mr A—I second the motion

Mr. C—It has been moved, *etc* (Undebatable) All in favor say *aye*, opposed, *no* The motion is carried and the question is before the assembly

Mr U—I move that this matter be referred to a committee composed of the treasurer and two other members appointed by the chair, said committee to report at our meeting two weeks from now.

Mr V—I second the motion.

Mr C—It has been moved, *etc* (Several take part in the discussion.) All in favor of referring this to a committee say *aye*, opposed, *no* The motion is carried As members of the committee I appoint Mr U. and Mr N

Mr B—Mr C.

Mr C.—Mr B

Mr. B—I believe that we ought to have a lecture course in our community Therefore, I make a motion that a committee be appointed to consider the advisability of undertaking this matter and report next week.

Mr Q —I second the motion

Mr. C —It has been, *etc* Any remarks?

Mr S —Mr C

Mr C —Mr S

Mr S —I think it is early in the year to take up this matter, besides we do not expect to have a business meeting next week I believe it better to wait until Mr. E. has been here, as he will be able to give us some advice in this matter I therefore move that the consideration of the question be postponed until our meeting two weeks from now.

Mr T —I second the motion

Mr C —It has been, *etc* Remarks? (Only remarks regarding wisdom of postponement were allowed) All in favor of the postponement say *aye;* opposed, *no* Motion carried

Mr A —Mr. C

Mr C —Mr A

Mr A —I move that we adjourn

Mr N.—I second the motion

Mr C —It has been, *etc* (Not debatable) All in favor say *aye;* opposed, *no* The motion is carried and the meeting is adjourned

**Writing up the minutes.** In order to assist teachers in writing up the minutes the following illustration with different names and dates, is given of the record of an actual meeting.

The seventh regular meeting of the Athenian Literary Society was held December 20 The meeting was called to order by the President The minutes of the previous meeting were read and accepted Eva M made a motion that each member pay ten cents to make up the deficit of the party bill Jane S seconded this motion Iva R moved that the motion be amended by inserting the words "on or before Jan 10," before the words, "ten cents" The amendment was seconded, and unanimously carried. The original motion as amended was then voted upon, and unanimously carried Roll call, to which each member responded with a quotation concerning music, then followed, showing all members present After roll call the following Program on Music was presented

1 Song "Kellar's American Hymn"—the school
2 "A Brief History of Music"—Helen K
3 Declamation "The Singing in God's Acre"—Jane B.
4. "The Value of Music in the Rural School"—Mary T.
5 Talk "Italian Music"—James W.
6 Song "Santa Lucia"—by Girls' Glee Club
7 Victrola Selection "Il Trovatore"
8 Talk "Music in Ireland"—Henry M.

9. Solo "Mother Machree"—Lisa P
10 Talk "German Music"—John H
11. Piano Solo "Beethoven's Farewell to the Piano"—Esther I.
12 Talk "American Music"—Thomas E.
13 Piano Solo "Robin's Return"—Beulah B.
14. Critic's Report—Zetta A
15. Song "Soldiers' Chorus"—Boys' Double Quartette

As this concluded the program, it was moved and seconded that the meeting adjourn This motion was carried, and the president declared the meeting adjourned Respectfully submitted—S J, Secretary. Dated, January 10, 1936.

TREASURER'S ACCOUNT

*School Society* *Sugar Grove School*

*September 4, 1934 to June 7, 1935*

| | *Receipts* | | *Expenditures* | |
|---|---|---|---|---|
| (1934)<br>Sept. 4 Cash on Hand | 4 | 30 | | |
| Sept 14 25 Dues @ 5¢ each | 1 | 25 | | |
| Oct 31 Expense, Halloween Party | | | 1 | 80 |
| Nov 27 Thanksgiving Basket sent | | | 2 | 45 |
| Dec 21 Receipts from Entertainment | 10 | 05 | | |
| (1935)<br>Jan 14. Bought *Robert's Rules of Order* | | | 1 | 50 |
| Feb. 12 Postage on Bulletins | | | | 20 |
| Mch 15 Net Receipts—Box Social | 15 | 30 | | |
| April 24 Bought New Flag | | | 7 | 30 |
| May 7 Bought Tree for Arbor Day | | | 1 | 75 |
| May 31 Balance | | | 15 | 90 |
| Total | 30 | 90 | 30 | 90 |
| June 7 Cash on Hand | 15 | 90 | | |

Signed, ANDREW BREWSTER, Treasurer

**Keeping the treasurer's account.** The children should be taught (as a supplementary exercise in arithmetic—if desired) how to keep an account and how to balance it The importance, indeed the absolute necessity, of keeping an accurate account of all public money, needs to be thoroughly impressed upon the minds of the pupils Every penny must be accounted for—a lesson both in good business practice and in good citizenship One right way to do it is shown on page 249

**The committee system.** In any well-conducted rural school the teacher will find it very helpful to make use of the committee system in carrying on the work of the school Pupils can aid much by serving on committees, but of course no pupil should be compelled to do janitor work Children can be so trained that they will be pleased to render services for their school, and anxious to do so. Experience demonstrates that most children co-operate very willingly and cheerfully.

No committee system will work itself If such a plan is to train the pupils and if it is to further the work of the school, the teacher must supervise the system Pupils will need definite instruction concerning their duties, and motives will need to be furnished in order to accomplish results.

**Boys' and Girls' 4-H Clubs.** The reason that this particular type of club activity has had such a remarkable development is that it is sponsored and supported by federal, state, and county governments and that, also, it is directly concerned with better farming, better rural and home life, and better boys and girls The membership is voluntary, the only essential is that each boy or girl shall learn by doing and shall carry out useful projects Leaders direct the work, records are kept, public exhibits are made at the county fair or elsewhere, and in all phases of the work practical projects are the very essence of what is done Boys raise sheep, calves, hogs, poultry, and horses and do intensive work in the raising of grain and other crops; while the girls are largely engaged in developing skills in the various domestic or household arts They also take part in many of the same projects as the boys The writer knows of

a very successful county fair which has been conducted for several years entirely by the 4-H Clubs of the county This fair is a credit to any county The exhibits of live stock, domestic-science products, and educational projects found here are numerous and many of them excellent in quality

The training which boys and girls get through 4-H Club work is of the greatest value The work is closely supervised in many counties by co-operative leaders of various types, county agricultural agents, county 4-H Club leaders, home-demonstration agents, and other men and women in official capacities The boys and girls are brought into contact with merchants, manufacturers, college professors, live-stock breeders, domestic-science specialists, bankers, and other leaders, educators, and able people in various walks of life They learn how to do business, how to keep accounts, how to co-operate in carrying out a common enterprise In connection with the various necessary meetings the young people get training in the methods of deliberative assemblies, as described and stressed in this chapter

Through the Extension Service of the United States Department of Agriculture in co-operation with the state colleges of agriculture, the 4-H Club work is now a permanent national educational movement supported by federal and state appropriations Some years ago the passage of the Smith-Lever Act in Congress made provision for extension education through club activities and definitely settled such a program as a continuing nation-wide activity This co-operative Extension Work of the United States Department of Agriculture now brings together into one great national organization all of those hitherto isolated and relatively weak local clubs which formerly lacked large power and influence because of their merely local sphere of action The support and the backing of county, state, and federal authorities now give the 4-H Clubs such a prestige as to make them the most significant movement for the betterment of country boys and girls and the rural population in general ever launched in this or any other country.

The general program of 4-H Club activities is a broad and comprehensive one It involves much more than farm and home projects The element of play is not ignored Opportunities are offered for the exercise of individual abilities in a wide range of social and civic participation. Dramatics are stressed during the winter months, the element of competition or friendly rivalry is used to advantage Speaking contests and dramatic programs similar to those of the Little Theatre are common and of great benefit By the use of a variety of scoring devices the achievements of young people are measured and duly recorded The contest idea is widely and profitably utilized in strictly agricultural and domestic-science fields, in the great variety of projects, and also in the intellectual contests

Members are admitted to 4-H Clubs as young as ten years. The upper limit is twenty years Most of the work is for children and young people from twelve to eighteen years of age. There are now nearly 1,000,000 4-H Club members in this country The emblem is the four-leaf clover and the four leaves stand for the *head*, the *hand*, the *heart*, and the *health* of each boy or girl The pledge of the club member has deep significance:

I pledge .

My *head* to clearer thinking,
My *heart* to greater loyalty,
My *hands* to larger service, and
My *health* to better living,
for my club, my community, and my country.

**General suggestions** 1 *Teach the exact expressions in parliamentary practice* The proper thing to do is to write out the form and have the pupils commit it to memory For example, the chairman says "A motion has been made and seconded that a committee of three be appointed to keep the front hall in order. Are there any remarks? If there is no discussion all that favor this motion will signify it by saying *aye,* those opposed, *no* The ayes have it and the motion is carried I will appoint Helen, Bernice, and Oliver on this committee to serve during the month of October Helen will act as chairman of the

committee Is there any further business to come before the meeting? If there is no further business a motion to adjourn is in order" Consult the illustration on pages 244 to 248 for other examples of the words to use

2 *Make regular use of Robert's Rules of Order.* Be sure that the school has a copy of this indispensable book, then teach and train the older pupils how to get the necessary information from the book The Table of Contents and the Index will be found useful The teacher should select some of the important items and present them to the children in oral exercises Some of the upper-grade pupils can be taught to give helpful talks on the kinds of motions, on amendments, and on other phases of parliamentary practice This is good material for oral language work Such talks may well find a place on the society programs.

3 *Teach and train pupils how to conduct the annual school meeting* Show how a chairman is elected and how the clerk keeps the minutes The teacher should find out exactly what necessary business must be done, perhaps in her particular district, and then instruct the children in the correct way of doing it A certain amount of money must be appropriated, certain repairs are to be made, some books and school equipment are to be purchased Have the children write out and make the necessary motions The teacher will need to instruct repeatedly in this connection and carefully to supervise the work Get from your school clerk the actual items of business that were transacted at the last annual meeting Such training is needed in every rural school district

4 *Teacher and pupils may impersonate the cabinet* The teacher acts as the president, sitting at the head of the table, while ten of the older pupils represent the different secretaries Each pupil will need to post up on the work of his or her department, then under the leadership of the president (the teacher) the work of the various departments can be brought out in the general discussion This exercise is also illustrative of what may be done with other subject matter.

5 *Let the children manage the society themselves.* The teacher must guide and direct the work and make suggestions from time to time, but the children, by holding the offices and by acting on the committees, may and should be taught to shoulder responsibilities Arrange to have every child hold an office or act on a committee sometime during the year All the children need the practice, especially those who are not naturally leaders

6 *Have the program for each meeting planned several weeks ahead of time.* The program should be made out very neatly on a good quality of paper, in ink, and posted on the bulletin board where all can see it In this way each child knows when he is to appear and has plenty of time for preparation The committee on special days can make good use of a correct list of such days. In consultation with the teacher plans can be made in advance in time for the suitable observance of each occasion

7. *Be sure each child has prepared his part well* It is unfair to a pupil and to the audience to have the child appear before he is sufficiently prepared Older pupils can often help in directing the necessary attentive repetition by the younger children Prompting is usually an embarrassing procedure, in general it is quite unnecessary Pupils should get the idea that they will not generally need to be prompted Even timid children can learn to get their parts and to give them acceptably Nervousness and timidity can be overcome by suitable practice in most cases This is one of the duties which the school owes to boys and girls It is of course understood that children should not usually be expected to do as well as adults, although many will do better. The writer has sometimes witnessed public exercises in rural schools when he has felt sorry for the children because the teacher had evidently not done her part well

8 *Do not try to have long, elaborate programs* It is far better to have a short program, well given, than a long one in which the children stumble through their parts because there was not time for ample preparation Besides, long programs become

tiresome and pupils lose interest Perhaps a program lasting thirty to forty minutes is long enough in the average rural school; a program of an hour for the mothers' meeting or the community-center gathering may be quite adequate. The reference here is to the literary program

9 *Encourage those who keep the record books to do so neatly and in proper form* It is well to have the secretary hand in his report to be corrected every week before copying it into the secretary's book This means that the first draft will be on loose paper for the teacher's correction A good book should be provided for these minutes—good paper and strongly bound. A suitable label should be pasted on the front cover The treasurer needs a book containing debit and credit columns, and the idea of *debit* and *credit* must be thoroughly taught Every monetary transaction is either a receipt or an expenditure. Teach and train how to balance an account Instruction in keeping both the secretary's and the treasurer's book should be given to all members who can understand.

10 *Make society activities a real training school in democracy* Remember that the children will some day be actually carrying on the civic work of the community The school is the place to learn how to conduct a public meeting and to do it right. Such work is much more important than many other things which rural teachers spend time in doing Skill is the result of intelligent, attentive, motivated repetition. Skill comes only by practice under the inspiration and guidance of clear and correct ideals The teacher must furnish standards and then motivate the work to secure needful interest.

## REVIEW, TEST, AND PROBLEM EXERCISES

1. Find out what business is to be transacted in a certain school district at the annual meeting, then write out in proper form the various motions necessary

2 Make out a good literary program of thirty minutes for the school society in a rural school.

3. Make out a fifteen-minute practice exercise in parliamentary usage, giving motions, amendments, and second amendments.

4 There should be a place for current events on the society program. List ten current-events topics which you think suitable for children in a rural school and tell how such subject matter should be presented

5 Often there should be response to roll call with something worth while on the part of each pupil Write a list of several kinds or types of suitable responses according to the nature of the theme of the program, for example nature subjects, pictures, music, famous people

6. Indicate fifteen different central themes or general topics for society programs, such as music, masterpieces in paintings, inventors, authors, holidays.

## REFERENCES FOR THE TEACHER'S READING AND STUDY

Read the articles on Parliamentary Practice and on Boys' and Girls' 4-H Clubs in the *World Book Encyclopedia* (1935)

See also pages 308 to 311 and page 318 of *Civics Through Problems*, by Edmonson and Dondineau, The Macmillan Company This company also publishes the *Textbook on Parliamentary Law* by Hall and Sturgis

*Parliamentary Usage* by Emma A Fox is published by Doubleday, Page and Company

*Robert's Rules of Order*, published by Scott, Foresman and Company, is a standard book on parliamentary practice and widely used The price is $1.50.

# CHAPTER XIV

## RURAL SOCIAL-CIVIC MEETINGS

**Why get together?** If the principle of democratic government is to prevail in America, people must be trained to the idea of organization, co-operation, and the free discussion of their common problems Formerly the country schoolhouse was more frequently used than today for gatherings of all sorts—the debating club, the lyceum, the old spelling bees Along with the decrease in the use of the rural schoolhouse for social and civic gatherings, there has been an increasing tendency (and a truly alarming one) for country people, especially the younger people, to go to town or city for their social recreation and amusements, many of which are artificial and more or less demoralizing

It is only within comparatively recent years that various agencies have been set in operation in the rural community to give the rural population, old and young, an opportunity for expression and for growth and development through clubs and associations of various sorts. Emphatically, our young people always have found and always will find some way, legitimate or otherwise, in which to express their social instincts If natural wholesome means are not provided by those in positions of leadership, young folks will take matters into their own hands for better or for worse—often for the latter

There is the greatest need for the development of the neighborhood spirit, and this can come about only through a well-organized neighborhood The task of leadership often falls to the teacher, no doubt rightly so It is to the rural school that we must look for the initial steps in this great co-operative enterprise, this national task of training all our rural people for real participation in our great scheme of government If the teacher does not start things, often nothing will be started The result

may be a run-down neighborhood, the opposite of an organized, active, co-operating community. Many teachers shrink from the task of starting a neighborhood club or a parent-teacher association. However, the job is not nearly so formidable as it looks. If the teacher will only study this problem, she will soon become enthusiastic, she will find people in her district who are capable of maintaining the organization. Let us point out some ways and means of accomplishing concrete, tangible results.

**Kinds of meetings.** At the present time all sorts of organizations are in more or less active operation throughout the country. Some of these are for young people especially, others are for the older members of the community. Community clubs are now very common and the Parent-Teacher Association has come to have a large and influential place in many rural school districts. The P. T. A. is considered in the chapter devoted to the relations of parents and teachers. These various organizations have different aims, most of which may be summed up in the terms: *economic*, *educational*, and *social*. The early lyceums, debating societies, and singing schools were largely educational and social in their character and operation. In later years there has grown up a great variety of clubs which have had for their dominant aim the improvement of the economic condition of the farmer. The Patrons of Husbandry, popularly known as the Grange, was at one time a very thriving agricultural society and still is active in some sections. It has a distinctly social as well as an economic purpose. In later years the American Society of Equity has had a most flourishing growth and a nation-wide increase of local organizations. At the present time the Farm Bureau is a powerful organization with a large membership in many states. There are also many thriving Dairy-Test Associations, co-operative stores, co-operative elevators, and other farmer unions with economic objectives. The Farmers' Union and the National Nonpartisan League have also exerted a wide influence. Country-life associations have had a vigorous existence in many states; many times the district or neighborhood associations have been united into a strong county organization

A recent meeting of a community club, which has now been in active operation for many years, was held in one of the larger houses of the neighborhood About a dozen rural teachers were present, there was a large attendance of farmers, their wives, and others from a territory comprising several school districts. The program was educational, but it was also noted that the farmers were buying twine and coal through co-operative methods—an economic phase of the organization

**How to organize.** It is important that no mistake be made at the start If the first gathering is a failure it will be more difficult later to overcome a bad beginning No effort, therefore, should be spared to make the first meeting a success

Many times a community club may well grow out of a simple school program or evening entertainment If the teacher plans to start in this way, she should make sure that this school program is a good one All the pupils should take part At such a gathering the teacher should make a special effort to meet the parents and others and to get acquainted

When the teacher has had two or three such evening school programs, the time may be ripe to get some of the older people to take part in some way After several people of the district have assisted the teacher and the school in putting on a successful entertainment, it will not be difficult to effect an organization of the older people

Talk with several people about the advisability of forming a community club of some sort In repeated conversations with patrons and others the teacher will be securing that co-operation which is necessary to make the enterprise go It often helps to have some member of a successful community organization present to tell how to go about it and to answer questions If this person shows genuine interest and is a good talker, the enthusiasm will prove contagious

Call a meeting of all who should be members of the new organization. Previous to this first meeting the teacher has paved the way to a sympathetic conference by her conversations with various people of the district At this meeting all details will be

fully explained and a final decision made to launch the new enterprise Do not be discouraged if everyone should not show interest in the proceedings Often significant results come out of small beginnings

At the first meeting the teacher, whom we are assuming is acting as leader, will give a short talk in which she will carefully state the purpose of the proposed plan and show its chief benefits to the people and the community It is important that the teacher know exactly what to say and that she present it clearly This requires thoughtful preparation All the details for this first meeting should be set down on paper in order This will tend to avoid embarrassing mistakes and breaks in the program

At this first meeting it is well to have a brief program which will precede the organization proceedings As a part of this program there may be an outside speaker who should not talk more than fifteen or twenty minutes This speaker may be the county superintendent, a high-school principal, or possibly someone from the state superintendent's office, or from a teachers' college Perhaps the president of some neighborhood club or association can give a short, inspirational talk

The next step is to elect officers, whose duty it will be to get a program ready for the next meeting and to present a constitution for the club to vote upon The necessary officers are a president, vice president, secretary, and treasurer Four committees will meet the requirements, as follows executive committee, improvement committee, program committee, and publicity committee

When the constitution is adopted and the committees are appointed, the machinery has been set in operation for a successful organization It will now be necessary, however, to have some leader, properly the president of the club, who will see that the people do their duty on committees and in presenting programs It is usually best for the teacher not to act as the president She can be of greater service in an advisory capacity, moreover, the important thing is to train the people of the community to assume responsibility and to make the enterprise a success of their own initiative and co-operation.

**Kinds of gatherings.** (1) The school entertainment This may be held in the afternoon or in the evening, depending upon circumstances (2) Programs in which both children and older people take part These are usually held in the evening. (3) Farmers' clubs In these meetings topics of interest to the grown-up people are presented by members of the community and by outsiders. Children also often contribute to these programs Frequently special meetings are held which are attended only by adults. (4) Special occasions, such as farmers' institutes, Fourth of July celebrations, closing day of school, Memorial Day exercises

**School exercises.** For your school programs you can draw upon your regular school work A ten-minute exercise with a reading class, well prepared, is a most entertaining feature Tell the class sometime, say from two to four weeks before your program is to be held, that each pupil will read one of the lessons between certain pages, including from 20 to 40 pages The result will be that the children will do their best to master these pages and thus be able to read any of them with expression. Much of the language work can also be used on the program

Spelling exercises may be included Tell the children of a certain group that they will spell for ten or fifteen minutes, taking any of the words between certain pages All of them will try to stand up during the whole period The result will be a mastery of all the words on those pages

Rapid arithmetic by the pupils at the blackboard is very interesting, provided there is sufficient room The writing of numbers and rapid easy work in the four fundamentals may profitably be taken up for ten or fifteen minutes Special problems may also be used, such as those relating to land or lumber Do not include too much at one time

**Community singing.** It always adds to the enjoyment of a community center gathering to have all join, so far as possible, in singing some of the old familiar songs which nearly all people like to sing and to hear In order to make such singing a success, there should be a capable leader; and enough copies of the

words of the various songs should be available so that at least every two persons, preferably each person, may have a copy. If the leader can arouse the enthusiasm of the people by a few well-chosen words relative to the importance of all taking part, so much the better. If the singing is to be worth while there must be the good spirit—the will to sing, so to speak Most people can sing, if they will only try, under the skillful leadership of some man or woman who can carry the tune clearly and strongly The leader should also be a good talker—if possible, someone who can animate the crowd, get them interested and in a good-natured responsive mood This will add materially to the pleasure of the occasion

Certain songs are good for community singing, the teacher should train her pupils so that they can lead in good form when occasion requires Here is a list of thirty good ones America; America, the Beautiful, Battle Cry of Freedom; Battle Hymn of the Republic, Columbia, Gem of the Ocean, Keep the Home Fires Burning, The Marseillaise, Smiles, Over There; Soldiers' Chorus, Star Spangled Banner, There's a Long, Long Trail; When Johnny Comes Marching Home, Onward Christian Soldiers; your own state song, Old Black Joe, Love's Old Sweet Song, Old Folks at Home; Massa's in the Cold, Cold Ground, Lightly Row, Holy Night; My Bonnie, The Little Brown Church in the Vale, Swing Low, Sweet Chariot; Come Thou Almighty King, My Old Kentucky Home, Juanita, Santa Lucia, Sweet and Low, Auld Lang Syne.

There are several good low-priced song books; three of the most useful collections of common songs for country schools are the following

1. *Twice 55 Community Songs;* C C Birchard and Company, Boston, Mass
2. *The One Hundred and One Best Songs,* The Cable Company, Chicago
3. *The Golden Book of Favorite Songs,* Hall and McCreary, Chicago

These song books, in paper covers, sell for only ten to fifteen cents each Send to the three companies for their price lists.

**Service of a country newspaper.**[1] A country daily newspaper in a midwestern state had the distinction some years ago of being the first paper to establish a community-service department, with help to rural schools and rural-community organizations as its chief purpose. The Good Times Club, designed as an organization especially suited to the needs of children in one-room and small graded schools, enrolled, within a period of two years, more than 4000 children, representing 190 school branches in five counties. Monthly recreation programs were sent to each school branch and a long list of entertainment and program materials, handicraft helps, and other extracurricular aids were offered to teachers at small cost Materials were sent on approval when desired

An interesting outgrowth of the Good Times Club service was found in a series of athletic and physical tests taken with the aid of such simple equipment as practically every rural school affords Another development was an individual point system for school pupils and a patron's point system, in connection with which honor buttons were offered to pupils and honor pennants to schools for certain achievements

An original plan for graded music-memory contests was inaugurated, by which the younger pupils in the one-room schools participated to the full extent of their ability Prizes for local and county music-memory contests were furnished

Kite making was promoted in connection with township and county playdays, directions for making kites being furnished and prizes offered to schools whose pupils scored the highest number of points in playday tournaments

A portable motion-picture projector, operated with either a 110- or 50-volt current, the latter drawn from storage batteries when necessary, was used to present film programs in rural schools, community halls, and churches. Free films were procured from the Bureau of Visual Instruction of the State University.

This newspaper carried a Good Times Club section in its

[1] This section was originally written by Florence Slown Hyde

week-end edition issued Saturdays This section featured letters written by rural school pupils telling about school activities. Letters were graded each month by teacher-training students and prizes were given to the four that received the highest grades Teachers found this news-letter writing a real help in the motivation of language work.

The Community Service Department of this newspaper co-operated with rural-community clubs, local Farm-Bureau and Grange organizations, farm-women's clubs and other rural groups that desired assistance in connection with recreation or community-welfare projects. The Service Department responded to any need that might arise, either directly and personally or by referring the applicant to other agencies in county, state, or nation

No attempt was made to promote preconceived plans or to displace the program of any existing agency On the other hand, interpretative articles about the work of educational forces and about every worth-while project carried on by any and all organizations were published frequently by this newspaper.

**Information concerning your flag.** The AMERICAN FLAG is the symbol of the brotherhood of man; it stands for courage, for chivalry, for generosity, and for honor To bear the Star Spangled Banner is an honor; to own one is a sacred trust, for it is the emblem of freedom, equality, and justice to all The flag should not be hoisted before sunrise, nor allowed to remain up after sunset When being raised or lowered, it should not be allowed to touch the ground When the national colors are passing on parade or in review, and when they are being lowered at sunset or the "Star-Spangled Banner" is being played, spectators should, if walking, halt, and, if sitting, rise and stand at attention with hats off The flag at half-staff is a sign of mourning In placing the flag at half-staff, it first should be hoisted to the top of the staff and then lowered to position; preliminary to lowering from half-staff, it should be raised to the top On Memorial Day, May 30, it should fly at half-staff until noon and at top staff from noon until sunset When a flag is dis-

played from a horizontal staff or rope, the union or blue field should be away from the building from which it is displayed.

**Pledge of allegiance procedure.** The *Pledge of Allegiance* was given, under the leadership of *The Youth's Companion*, by more than 12,000,000 Public School Pupils during the National Public School Celebration of October 21, 1892. So patriotic and appropriate was this Pledge of Allegiance that it has been perpetuated, and is given in thousands of schools. It may be called the national salute, and its universal adoption by public schools and patriotic organizations is strongly advocated by educators everywhere.

The flag may be draped against the wall near the teacher's desk, or preferably, permanently mounted on a staff and stationed near the desk. The Pledge of Allegiance may be observed in the following manner:

1. Display the flag at the teacher's desk.

2. At a given signal every pupil stands and turns his face toward the flag, hands to the side.

3. At the next signal, each pupil should give the *civilian salute*. This is done by standing with the right hand over the heart, while the pupils in this position, repeat together the following pledge: *"I pledge allegiance to the flag of the United States of America, and to the Republic for which it stands, one Nation indivisible, with liberty and justice for all."* At the words "to the flag" the right hand is extended gracefully, palm upward, toward the flag, and remains in this position until the end of the affirmation, whereupon the hand immediately drops to the side. Then, still standing, the exercise may close with our National Hymn, "America." This is the civilian salute. Persons in uniform should render the right-hand salute, as it is called. When the flag is passing by, men and boys should remove the headdress with the right hand and hold it at the left shoulder, hand over the heart.

In some public schools the pledge is given daily at the opening of the morning session. In most cases, however, it is observed at the opening of the school on Monday morning. In many

states the flag must be displayed on every school day from a staff either on the building or in the yard In such cases it should be raised as stated on a previous page, so far as possible.

**Suggestions for school and community meetings.** It is important that community center and school programs be conducted properly and that such meetings be truly successful For this reason, the following suggestions and cautions are given They are the result of the experience of persons who have been working in country schools for many years

1. The primary purpose of the school must always be kept in mind This purpose is to give the children of the community an elementary education, an important phase of this elementary education is the mastery of the essentials of the fundamental branches

2 Care should always be taken after a social function of any kind that the schoolroom is in proper condition for the regular school work before its next session opens

3 Too much time should not be taken from the regular school work to prepare for the school entertainment We should not get the idea, however, that some time so taken is actually wasted, it may be necessary and advisable to use a portion of regular school hours, at times, to prepare for truly educational programs

4 The exercises should be carefully planned Even the details of the room management should be looked after, so that the audience may be as comfortable as possible The board and others should co-operate with the teacher, people should be made to feel that they are welcome

5 Tact should be used in making the selections for the program The feelings and prejudices of the people should, to some extent at least, be taken into consideration There is so much good material for program purposes that it is not necessary to use anything that might offend

6 We must not expect too much from the teacher We should get others to help The teacher, it is true, must be held responsible for any contributions which the children make; but it is too much to expect the teacher to be at the head of a literary

society in which the whole community takes part Besides, it is well to have the burdens and responsibilities distributed among the people The teacher may leave the community at the end of the year, it is well to have the people themselves trained to go on with the work

7. When this work is first undertaken it should be begun in a modest way The selections and the program should be simple and not too long

8 Those who have the preparation of programs in charge should beware of the tiresome, long-winded person, whether local talent or an outsider

9 Do not be too anxious to introduce unusual or exciting features The purpose of these meetings is to get as many as possible to take part If spectacular exhibitions become common, they will have a tendency to discourage the more modest efforts of the people themselves While it is an excellent plan to have the county superintendent or any outside person give an occasional illustrated lecture, yet we do not want to go to the other extreme and make people feel that in order to have anything worth attending we must have some outsider present or some unusual feature

10 Occasionally it happens that people from the outside, sometimes from a near-by village or city, will go out into the country to attend one of these evening meetings In this group may occasionally be found persons of superficial judgment who will criticize the efforts of those who are trying to do their best. While men and women of the right spirit will never do this, it is well to be prepared to encounter and check any people of this type who may happen to attend Just how this is to be done, particular conditions will determine

11. We should in every possible way try to avoid factionalism These meetings should be a means of cementing the people of the district into one community; anything that may cause any formation of factions must be studiously avoided

12 As the interest in these meetings grows, do not let their management become monopolized by either young or old. In

some communities the clubs have gone to pieces largely because comparatively young people have had the sole management in their hands In other communities interest has been lost because only older people have managed the organization and the young people have gradually lost interest

13 The teacher should always be careful not to assume a superior attitude toward the people of the community She should also be careful not unduly to force her own individual ideas or opinions upon them When the people assume a resentful attitude toward the teacher, her power as a community leader is seriously weakened if not destroyed

14. Train your pupils to talk in clear, distinct tones, so they can be understood Rehearse adequately so that children will not usually need to be prompted, at least not very much If a teacher must prompt anybody, she should do it without delay so that the child readily gets his cue It is quite embarrassing to everyone when any child must stop and painfully try to think of his part before an audience Tell him quickly, plainly, and quietly what to say or to do and go right on with the exercise

15 Arrange to let fresh air into the room A small country schoolhouse with little or no ventilation, crowded with people, is often a good place for the spread of infectious respiratory diseases. Open the windows occasionally if only for a few minutes Have persons appointed to look after this important matter Don't compel people to sit more than a few moments in a cold draft, however

16 Don't allow your pupils to talk loudly or to run around and disturb people during intermissions or at any other time Tell them beforehand what is right and what you expect This is certainly a part of their training in good citizenship. Sometimes some of the older young people of the district or from adjoining districts and towns do not manifest the best of manners They are loud in their talk and often in their actions The members of the board should assist the teacher in keeping such persons in order

17. Often there is good talent in the district which should be utilized for speaking or singing or both People usually need repeated and often urgent invitations to assist; but generally they are glad to help the teacher and the school and will add much to the evening's entertainment in many cases

18 Begin on the hour previously announced, if at all possible Parents, pupils, and others can be led to understand that eight o'clock, for example, means just that, although they may need some training In some communities tardiness is merely a bad habit, with no particular reason for it In any case and always the teacher must be good-natured, whether people are on time or come late Be the cordial hostess and receive people graciously

19 The program is not for the teacher's benefit, as she is simply the servant of the people The program is for the good of the boys and girls and of the people of the district It is a meeting *of* the people and *for* the people, and should many times be *by* the people, also Try to make the program instructive as well as entertaining The teacher does not have time for elaborate scenery and costumes or for foolish farces which usually have no educational value At least teacher and children need not be parties to putting on programs of questionable character and influence

20 Teach and train your boys and girls to stand straight, to walk erect and in line, and to talk out so that all may hear. The training which pupils receive in connection with public programs is a valuable part of their education and should be done right

21 Do not have too long or too difficult programs It is better to have a short meeting and have everyone go home satisfied than to draw the meeting out and have people tired An hour or an hour and a half is about the limit, as a rule Do not have too many meetings It is easy to overdo in both length and frequency, there is always a happy medium.

22 Remember that the purpose you have in mind will largely determine the character of the programs. The primary purpose

should be the development of the community, not the advertising of outside individuals When outside people are brought in, it should be for the purpose of giving the local people suggestions or inspiration for their own work

23 Make use of the school library and any other library which is accessible.

24 Among the persons that may be asked to help are the following: teachers, principals, superintendents, county officers, members of the school board, successful farmers who have become specialists in certain lines of work (such as fruit growing, poultry raising, dairying), physicians, war veterans, and American Legion men

25 In your school programs get every child to do something, if it be but to take part in a drill By grouping children all can participate without prolonging the program unduly

## REVIEW, TEST, AND PROBLEM EXERCISES

1 State five good arguments in favor of the get-together idea What modern inventions, customs, habits, forms of amusement, and tendencies interfere with people's getting together in community gatherings? What others aid it?

2. Outline a ten-minute talk by the teacher at a *first* community meeting. Prepare to give this talk in good form, and then practice on your classmates Or you can have the real, natural setting in a meeting at your own schoolhouse

3 Make out a Memorial Day program of speaking, singing, flag drills, or other appropriate items, which will take an hour or less

4. Outline a program for Armistice Day. Don't forget to include "In Flanders Field," "Your Flag and My Flag," "The American's Creed," the "Flag Salute" and "Pledge of Allegiance," and perhaps "The Gettysburg Address"

5 Use any sample constitution as a model and organize a neighborhood improvement club If you are a student, you and your class can practice on the problem, if a rural teacher, it will be possible for you actually to effect an organization of the people of your district

6 Write out a list of questions which will develop the meaning of the four stanzas of "America." Do the same for "America the Beautiful." Study these poems until you fully understand them

## REFERENCES FOR THE TEACHER'S READING AND STUDY

1 *Needed Readjustments in Rural Life*, 1925; American Country Life Association, 105 East Twenty-second Street, New York City.

2 ELSOM, J C, AND TRILLING, B M—*Social Games and Group Dances*, J B Lippincott Company. 1927.

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Send five cents to the Superintendent of Documents, Washington, D C, for the latest Educational Directory—Part IV This list of American Associations, Educational, Civic, and Learned, is useful. There are nine lists and directories in this 47-page bulletin, and complete addresses are given. It is revised each year.

## CHAPTER XV

## ELEMENTARY IDEAS ABOUT HUMAN BEHAVIOR

This chapter is written in the hope that it will stimulate the young teacher to further study and investigation. In this brief résumé nothing more can be done than to present rather summarized statements of a few basic ideas which should be given further careful consideration and much more detailed analysis by the student There are many excellent discussions of all these topics, which will enable the teacher to carry on her work more intelligently and more effectively A teacher who knows the facts of mental science is in a position not only to do better teaching, but more satisfactorily to understand and interpret the problems of human life, of her own personality, and of the personalities of her pupils and others Unless a teacher knows the fundamental reasons for what she does, her work will certainly be unscientific as well as more or less uncertain

**What does a teacher need to know?** Any teacher, rural or urban, needs to know a great many things She should know vastly more than she is expected to teach. The larger the background of knowledge and general information which a teacher possesses, the better Every good teacher is fairly well acquainted with a considerable amount of useful lore in a wide variety of fields She needs to know the facts of elementary science; she needs a general knowledge of literature and a special knowledge of children's literature; she needs to know all of the subject matter in the course of study; she needs a knowledge of school management, she needs to know how to make use of problem-project techniques and other teaching procedures, she surely should understand how to direct study activities, how to promote character and health development, and so on The special point in connection with this chapter is that a teacher

needs to know something of the spiritual forces and the mental materials with which she is constantly dealing. The chief concern of the teacher is with teaching and learning How do children learn? That is the most important question of all for the teacher She should be constantly inquiring not only how children learn, but also how she, the teacher, can best promote the learning processes. Human behavior, which includes human learning, is exceedingly complex If a teacher desires to be more than a mechanical manipulator of devices, she will go below the surface to see why and how the machine operates This chapter gives some glimpses into the mental background.

**Value of the scientific method and attitude.** The scientific method is the method of investigation of all the available facts, the scientific attitude is that of entire willingness to look patiently for all the necessary data and of unwillingness to draw conclusions on an insecure basis of limited knowledge Every teacher should know something of the scientific method of study and every teacher should learn the importance of suspending judgment until all the available evidence is in In the older books on educational psychology there were a multitude of statements which today we know had no scientific foundation whatever. Often the premises were wrong as well as the steps in arriving at conclusions. Today much stress is being placed upon direct experiment and observation. Thorndike's conclusions are largely based upon experimental data. A new psychology of learning has been evolved during the past quarter century as a result of research and experimental studies made by E L Thorndike, J B Watson, Wm McDougall, I. P Pavlov, and many others The scientific method is impersonal, precise, experimental, exact, and deals with the observation and measurement of particular, controlled phenomena. In one vital sense, every teacher should be a scientist, or at any rate should have the scientific attitude in that she has a thoroughgoing respect for facts.

**Objective study of behavior vs. introspection.** The objective study of behavior is the same scientific method of directed

observation and experiment which is now used in every field of science, in biology, for example, as well as in psychology Until about a generation ago the accepted procedure in psychology was largely that of introspection Literally, this looking inside is of little scientific value because we are forced to accept the conclusions of one person concerning his own personal sensations In an objective study of behavior, however, it is possible for any number of persons to observe the reactions of any other selected group Some elements of personality can be learned only by introspection, but psychologists today are suspicious of the exclusive use of the introspective method It is now the general feeling that the only logical and safe procedure is the experimental observation of the activities of men and animals in a purely objective impersonal manner. However, introspection has value and no doubt always will have as one means for the study of human nature and human behavior

**Are we born that way?** To what extent has heredity made us what we are? And what has been, or is, the influence of environment? Nobody knows the exact answer to these questions. Nobody can give the true relations between nature and nurture It is obviously certain that we are shaped by both heredity and environment. Which factor is the stronger depends upon circumstances and upon individuals Each of us is limited definitely and certainly in his physical, mental, and moral capacities or possibilities because of his inheritance. From our parents we receive a certain organization of the nervous system, for example The size of the body and of various organs of the body are largely matters of heredity, so far as the possibility of education is concerned the particular type of nervous system is a matter of basic importance The laws of heredity cannot be evaded We are obliged to accept them for better or for worse. But accepting the laws of heredity as inevitable, the great influence for the teacher to stress is environment by which is really meant all educative forces which mold our lives Given a certain type of hereditary capacity, the chief question for the teacher is one of development, of

guidance, of education Because of wrong educational environment, because of weaknesses of personalities, it often happens that promising inherited possibilities come to nought It is the environment to which we give attention and to which we respond that changes us

**Nature of instinctive behavior.** Human beings are born with certain innate complex tendencies to behavior which are called instincts These responses are more complicated than reflex action and are not in the nature of learned behavior The conduct of the lower animals is largely determined by instinctive tendencies rather than by learning On the other hand, the human infant is relatively helpless at birth and during the prolonged period of infancy *learns* almost everything that it knows or can do In common with many of the lower animals, the child has certain native urges, such as those of play, self-assertion, pugnacity, eating, desire for companions, interest in others, disposition to acquire and to hoard, and so on Writers do not agree here in their enumerations or in their classifications These tendencies afford the basis for the education of the child It is because of the instinctive tendencies to action that human education is possible Innate tendencies should be used and guided rather than thwarted Children do not inherit knowledge; they inherit tendencies to behavior Some instinctive tendencies do not require much modification, but most of them need definite redirection to enable men to live social lives It is sometimes difficult clearly to distinguish the urge of a fixed habit from that of a native impulse, but the practical consideration for education is that both are strong, motivating tendencies

Dr Ragsdale states in a letter to the author that "the instinct theory is seriously questioned by many psychologists of today." And Dr James B. Stroud in his *Educational Psychology* [1] says that

> The concept of instinct should be excluded from human psychology. Its use leads to confusion There is no valid evidence that man is natively endowed with any of the complex, patterned reactions com-

[1] STROUD, J B —*Educational Psychology*, The Macmillan Company 1935

monly called instincts As the term is customarily defined in psychology, there probably are no human instincts As the writer has already suggested, we have more specific terms which cover the latter phenomena, namely, reflexes, biological urges or needs, and emotion The suggestion is made here that we use these terms when the phenomena which they signify are meant, and that we reserve the term instinct to designate complex, innate, patterned reactions among animals . . *Whatever is laudable in man is learned, it is the product of social heritage or of intelligent adjustment.* The doctrine of instinct, as customarily stated, has no value for education . . The student should not form the impression that the native endowment of man is of no consequence in his mental development.

It is man's native, innate *emotional*, rather than his native, instinctive tendencies which play so large a part in his learning and in his general behavior.

"**No psychosis without neurosis.**" This means that there is no psychical effect, whatever that may be, without the correlative or corresponding physical activity of the central nervous system All learning is dependent upon the action of the nervous mechanism The behaviorists do not think it necessary to postulate any form of consciousness or mind, as such and as an entity Mind for the behaviorists is nonexistent and therefore introspection must be an absurdity Whatever truth there may be in that theory, and it has never been either proven or disproven, whenever any sort of learning takes place, because of experience, definite changes are recorded in the nerve tissues of brain and spinal cord The basis of the teaching-learning process is purely and entirely physical, without a doubt Learning starts with sensation, the basis of which is found in the irritability and conductivity of nerve tissues as they are found in the cerebrospinal system The brain comprises the cerebrum, the cerebellum, and the medulla; the spinal cord is a column of nerve tissues from which thirty-one pairs of nerves branch off. The basic element of the nervous system is the *neurone,* which consists of a cell body from which branch off the axones and the dendrites The co-operative action of neurons is made possible by what is termed the *synapse* where nerve fibers come

into contact but do not unite The synapse is a most interesting part of the nervous system from the standpoint of learning and the student should make a careful study of its nature and function

In *Human Behavior* by Colvin, Bagley, and Macdonald we find these statements regarding the synapse

> The *synapse* is the area where the end-brush of one neurone comes into close enough proximity to the dendrite of another neurone to permit the passage of the nerve impulse from one neurone to another In some respects the synapse is the most important part of the nervous system It is generally accepted that learning is the result of some change taking place at this junction of end-brush of the axon and the "shrub" of a dendrite Some physiologists believe that a chemical change takes place when a nerve impulse crosses from one neurone to another, others believe that the nerve impulse from one neurone, when it stimulates another neurone to activity, causes the dendrite of the latter to extend or to thicken so that it is closer to the end-brush Exactly what does happen is not known

Morgan and Gilliland in *An Introduction to Psychology* (The Macmillan Company) say that

> This name *synapse* signifies a "fitting together" and not a "growing together." Nerve impulses are conducted from the terminations of the sensory axon to the dendrites of the motor cells, but will not pass in the reverse direction There is greater delay in the passage of a nerve current through a synapse than along a nerve fiber. This indicates that the synapse provides a sort of obstruction to free flow of nervous energy From these facts it seems that the synapse holds the secret of much that transpires in our mental life

**Stimulus and reaction; situation and response.** Our behavior, no matter how simple or how complex, is manifested in reactions to definite stimuli The reaction hypothesis is now generally accepted Reactions of some sort are inevitable, as we react so are we and so do we become All forms of behavior, whether outward and evident, or more subtle and hidden, as activities of the glands including the endocrine glands, are explained in terms of stimulus and response In the case of sensorimotor experience there is very plainly a stimulus-response unit or

reaction unit. Today all forms of mental activities or experiences (some say consciousness) are also explained in terms of reaction to stimuli. The student should understand that many stimuli are acting at the same time, presenting what is termed a *situation*. Usually in any situation there are many stimuli producing their effect upon the nervous system. Whether we are swinging golf clubs, or manufacturing gastric juice to digest our dinners, or getting disturbed mentally over the poor shot on the links, in each case the explanation is the same—some response to some situation. Both situations and responses to them vary greatly in complexity. The teacher's work should consist in furnishing as many suitable learning situations as possible and in securing as adequate responses to them as her motivating procedures will permit. In teaching we attempt to determine and to control the character and extent of the child's reactions or responses in order to shape the type of his education.

**Starting and stopping; action and inhibition.** Responses or reactions are often checked or repressed; when this occurs we use the term *inhibition* to name the process. Activities of the lower nerve centers are inhibited by the higher centers. At the table you place something very hot in the mouth. The natural first impulse is at once to get rid of the irritating morsel or fluid, but your good manners prompt you to retain it even at the cost of considerable discomfort. One kind of stimulus or idea will check the action of another. Often when the reaction is prevented and there is thus a damming up of the natural outflow of nervous energy, the result may be an increase of the stimulus. When there is a conflict of ideas, the stronger ones will win out. Any idea that has a good deal of the emotional element in it will have greater force. Children need to learn to control some of their natural urges. There is some risk in too much repression, and there is likewise danger in too much freedom and gratification. One of the large functions of education is to teach self-control. Certain forms of inhibition should become habitual for the welfare of the individual and the good of society. In our civilization it is essential that primitive impulses

frequently be checked. It is often painful to have a neural impulse thwarted, but in the long run such checking is less painful than the giving way would be. By the use of good judgment, we can side-step or avoid stimuli that are too strong for us. We can mitigate the wear and tear on our nervous systems by modifying our desires.

**Nature of reflex action.** Reflex action occurs when the stimulation of an ingoing nerve sets up a nervous impulse that is carried to the central nervous system where it is reflected back in some sort of muscular movement or in the action of some bodily organ. Common examples of reflex action are crying out when startled, coughing, swallowing, winking, etc. For reflex action to occur, it is necessary that there be some stimulation of nerve tissue, that sensory nerve fibers carry the impulse to the nerve centers, that the impulse be switched over to an outgoing nerve path, and lastly that some form of muscular tissue be made to contract—the arm, for example, or the stomach muscles as in a case of nausea or whenever the stomach glands are made to secrete by the presence of food. These reflex movements are externally stimulated, are without mental control, and may be either conscious or unconscious. We do not learn reflex action. Such responses are ready-made for us, they constitute an essential nervous basis for learning. The entire human nervous mechanism is a wonderfully complicated and efficient system by which stimulations from the outer world or from the body itself are received and transmitted into the necessary reactions. Such stimulation and reflection of impulses constitute the ultimate physical cause for all mental life. Any ordinary reflex action typifies the physiological explanation of the most elaborate and complex human behavior.

**Conditioned responses modify behavior.** According to the behavioristic or mechanistic school of thought, all human behavior is made up of reflexes and conditioned reflexes. The latter are responses or reactions that have been changed by experience, environment, or education. In the case of the famous,

now classical experiment, of Pavlov, the Russian scientist, with his dogs, the reflex of the salivary glands was *conditioned* by presenting at the same time two stimuli, the taste of the food and the sound of a bell Through the application of the principle of *simultaneous stimulation,* and by much repetition, Pavlov's dogs *learned* to secrete saliva when they heard the bell ring This result was brought about by first showing the meat and ringing the bell at the same time After sufficient repetition, the ringing of the bell alone was enough to cause the salivary response Responding with a flow of saliva to the sound of the bell as a single stimulus is a conditioned response This discovery made many years ago has an important application in the work of the school, or in any learning in or out of school Very much depends on the associated responses which we experience Many of our likes and dislikes, our fears, our prejudices against people are developed in this way Dislike for certain foods is due often to unfortunate experiences which have never been corrected by clear thinking The wise parent or teacher makes an effort to offer simultaneously wholesome harmonious learning situations and not those which will later cause mental conflicts and difficulties

**How knowing begins.** The newborn babe *knows* nothing whatsoever It is, too, more helpless than the puppy, the kitten, the chick, and many other of the lower animals The baby can cry, swallow, and the like, and it can make various aimless movements with its legs and arms Although the child has no control over its movements and no apparent consciousness, these early spontaneous, automatic squirmings and jerkings afford the basis for future learning. The human baby is indeed helpless, but it has great possibilities for growth because of the extent to which it can *learn by experience* The lower animals have but limited power to learn It would seem that the first mental state, if it may be so called, is nothing more than a general feeling or sense of ease, comfort, or their opposites. Doubtless the beginnings of any mental activity are those of a sense or feeling of change or of difference. Now it is light, now

it is dark, now mother is here and now she is not The first few days practically all of the senses seem dormant; but they soon awaken Through the various senses the child gets his raw materials, his experiences, by which he learns How does he learn to know, to know that he knows, and to know that he is the knower? When and how does the child learn his own identity? That is a question for the psychologist to answer. The insight of the poet often gives us a suggestion, as when Tennyson sings.

The baby new to earth and sky,
What time his tender palm is prest
Against the circle of the breast,
Has never thought that this is I,

But as he grows he gathers much
And learns the use of *I* and *me*
And finds I am not what I see
And other than the things I touch.

**Securing the raw materials.** The extremely complex nervous system of man is so organized that it responds to a great variety of stimuli The irritability and the conductivity of nerve tissues make it possible to have sensations through and by means of the different senses. We are not only able to see, hear, smell, taste, and touch, but we also have pressure, temperature, pain, and muscular and organic sensations Through muscular or kinaesthetic sensations we secure data for the interpretation of movements, of position, of strain, and the like There is a most important sense of muscular effort due to sensations from the nerve ends in muscles and joints When an incarrying nerve is stimulated by sound waves, ether waves, or substances in solution impinging the taste buds, the first thing that happens is a sensation; but immediately the process of interpretation takes place and the person says, that is a foghorn, or that is a rose, or this is vanilla or lemon flavor, and so on. This interpretation is perception To have a sensation there must be some form of stimulation, the nerve impulse must be transmitted, and

there must be a reacting brain center We get many sensations from the internal organs—stomach, heart, lungs. So the raw materials used in learning all come through sensations which are immediately interpreted as we grow older and thus become perceptions or *percepts.* Through sensation physical and chemical energy is changed over into nervous energy, thus we get our data for learning The human nervous system is a marvelous receiving and reacting mechanism

**Interpretation of sensation gives perception.** All our elementary knowledge comes primarily and originally through our senses. How do we perceive a watermelon? Learning a watermelon by experience is a useful illustration of *sense perception* Various sensations are interpreted to mean the object, watermelon There is the object in space, the process of perception, and the mental result, the *percept* To perceive a watermelon we must use several senses The use of the eye as a means of learning is self-evident, but we must see not only the outer rind, but the tinted meat and the rows of shining black seeds How can we *hear* a watermelon? Chiefly, no doubt, in thumping the rind to determine ripeness *Taste* and *smell* are apparent, although some of us might be more discriminating through training in acuteness of taste and smell We *feel* or *touch* its smooth curved outer skin or rind We press to discover hardness or softness We say that seeing is believing We often get more accurate knowledge through touch which aids or reinforces sight in drawing conclusions As to *temperature,* we place the melon on ice so that we may have the sensation of coolness in the mouth This cool sensation is due not to taste, but to the temperature sense. Finally, no one has fully sensed a watermelon without *lifting* or *hefting* it Here we get a new sensation through the muscles. When all these various sensations are fused and then interpreted, we may say that we have the percept, *watermelon* However, this *sense-knowledge* is, of course, only the beginning of what we finally learn about watermelons Note that these beginnings in learning come only through actual personal observation and experience.

**Percepts—images—concepts.** It will help any teacher to get a clear understanding of these terms, because in all teaching and learning we are dealing with these mental products and also with the processes of perceiving, of forming images of both memory and imagination, and of developing general meanings or notions. In order to have a percept the object must be here and now and capable of stimulating the nervous system. We perceive through all of our senses, and percepts are usually complex products of many sensations. An image is a revived or recalled mental impression or experience. When I am looking directly at the fountain pen before me I have a percept of it through the eye, aided by the sense of active touch. I do not *see* roundness, hardness, smoothness. When I close my eyes, I can see the pen more or less clearly in my "mind's eye." That is an image and it is not as distinct and accurate as the percept. But, I also have a general idea of fountain pens. They have certain common qualities, as for example that of holding the ink in a cylindrical barrel. But they differ greatly in color, size, method of filling, type of pen point, etc. When the elements of likeness are fused together we have a concept of fountain pens in general. Concepts are essential for all generalized thinking. Concepts are the product of experience and their significant contents vary as experience varies. Here again we see the need for experience as the basis of all learning.

**Imagery—memory and imagination.** It is impossible to have a mental image unless there has been adequate sense experience preceding. A person born blind cannot possibly have any visual images. A congenital deaf-mute cannot image sounds. Memory is the power of retaining and reproducing past sensory experiences. It is due to changes wrought in the nervous tissue of the cerebrospinal system. Memory and habit are alike in that they are both dependent upon changes made in nerve cells and fibers, the neurons. They differ in the fact that memories are largely mental, while habits have to do, in many instances, purely with motor responses. However, we have emotional habits, habitual ways of thinking, and habitual attitudes. You

have a memory of Kipling's Recessional, but you formed a complex motor habit when you learned to drive a car or to operate a typewriter We have sensorimotor habits with which are associated various habitual feelings of ease, satisfaction, and the like There is no general faculty called memory There is no mental faculty of any kind We have *memories* rather than memory Experiences cause changes in various parts of the cerebrospinal system, and as there is an infinite variety of impressions made through the eye, the ear, and the senses of taste, touch, smell, temperature, and muscular effort, so there are any number of different memories, depending upon the nature and the extent of the original and repeated impressions *Imagination* is the power to reproduce past experiences and, in addition to this, to recombine them into something somewhat new

Memory images are expected to be as true as may be to reality But imagination may and does transcend all reality; by the process of recombination, new and often strange or weird mental products may be the result Mental imagery is necessary in memory, imagination, and thinking The process of perception is also impossible without recall Our stock of images determines our power in large measure in each of these fields Our experiences in life determine the nature and extent of our stock of images Man differs from the lower animals largely in the character, the scope, and the variety of his images The dog, cat, and horse, apparently, are restricted for the most part to a narrow field of sense impressions, and are evidently unable to store up the wealth of experiences that man has Human beings are the heirs of all the ages because of their power to image that which has been and that which may yet be

**Nature, formation, and retention of images.** People vary greatly in the character and the extent of their imagery Most people are able to form good visual images; the next most common power is in the field of auditory images A painter of portraits will have strong visual images, musicians need to be

able to image impressions received through the ear. Most people find some difficulty in imaging odors and tastes. It used to be thought that there were pronounced imagery types such as the visual type, the audile type, the motor type, but it is now known that usually persons who excel in one way are likely to show proficiency in all types of imagery. In teaching it is important to use concrete or picture images as much as possible, rather than merely abstract or symbol images. Words mean nothing in themselves. They are primarily only empty symbols; they need to be filled with the life of reality in the form of mental pictures. This is a daily concern of every good teacher. To aid memory and imagination, the school needs a good equipment of objective material, such as globes, maps, and measures, in order to make the sense impression strong. Objective teaching is a constant necessity in order to provide reality and real experience. Memory ability, in general, depends upon the nature of one's nervous system; this is largely a matter of heredity. Some people have far greater retentiveness than others, because their neurons are more easily modified and because the changes are more permanent. Health is of vital importance, if one would have an active retentive mind, he must have good blood and a sound nervous system.

**How can we remember better?** Images come to mind according to the law of association, that is, related ideas or experiences tend to suggest or recall one another. The number and the organization of associations probably has more to do with recall than anything else. It is the teacher's duty to present material in such a way that the neuron connections are many and of such a character as to reinforce each other. The basic law of association is this: Mental experiences occurring together tend to recur together. Try to recall several personal illustrations of this fact. If we wish to understand anything well and to keep it in mind, it is important that we bring to bear as many different senses as possible in the learning, resulting in a variety of *related images*. If clear, definite, and repeated *expression* in the best possible English is added, the result is more permanent.

Repetitions to insure the best retention should be attentive, intelligent, thoughtful, meaningful Teach meanings not words Make first impressions as strong, clear, and vivid as possible. Interest is the mother of attention and attention is the mother of memory. Poems should be taught as related, meaningful wholes. It is better to go through the entire poem each time Recall is more certain if we work on related, co-ordinated units.

**Cultivation of imagination.** Teachers should take pains to develop not only the ability to recall the memory images which pupils have gained through experience, but also the ability to recombine into new forms the products of their experiences. Most children know hills, and from these images they can, through imagination, picture mountains Few school children have seen the Amazon River, but by reading they can be guided in building very satisfactory mental pictures of it Every teacher should realize the need for abundant perceptional material The more actual memory images a child has the better he will be able to reconstruct these into something he has not experienced The teacher should use every means to secure clear and accurate sense-perceptional materials and then to guide pupils in using the resulting images when they are studying history, geography, literature, and other subjects Imagination is a practical phase of mental activity We use imagination in forming ideals, if the library readings are carefully directed, children will unconsciously develop very important ideals of life and conduct In order to cultivate imagination, the school should furnish an abundance of materials for developing a stock of images; it should provide adequate practice in teaching procedures; and it should guide and direct the child so that wholesome, healthful images leave no room for those that tend to weaken and destroy Both oral and written forms of expression are of great value Not only in language is there a means of cultivation, but also in all of the arts, including the household and the manual arts The teacher who understands the difference between memory images and those of the imagination will

adapt her teaching procedures to the cultivation of both recall and the picturing of what has not been sense-experienced.

**Nature and use of meanings.** What meaning does the word *home* have for you? It has precisely the meaning which your experience gives it, no more and no less. Your idea or meaning of *home* has been built up through your reactions to your particular personal environment. We say that such words as *home, house, book, watch, pencil,* etc., represent general ideas or concepts. They have general meanings, and are very useful, even essential, as a means for thinking. If we were obliged to think in terms of particular images, the process would be tedious, ineffective, impossible. When the word *house* is pronounced, you do not think of a particular building but of houses of all varieties and descriptions, large and small, of many rooms or perhaps of only one room, with all types of roofs, etc. The common quality is that of a building in which to live and to make a home for the family. A house is a place of residence for human beings. What meaning do you give to the words *patriotism, truth, temperance, state,* and the like? These words are abstract terms. You cannot image *truth* as you form a picture of *house*. But both of these are general notions. In the interpretation of sensations through perception we give meaning in terms of use or utility to the sense impressions. An apple is fruit to eat, a watch is to tell time, a pencil is to write. Our interpretations are in terms of our own personal behavior. The more experience we have, the broader and more accurate the meanings. Ideas or meanings are indispensable for all effective thinking and reasoning. In teaching, pupils should be guided in the use of general ideas, but every effort should be made to see that such ideas or meanings are based upon an abundance of perceptual experiences. Meanings grow out of particular percepts and images. The more associations a word suggests the greater its meaning. What does the term *church* mean to you? Does it mean merely the building? Or have you been a member of a certain church and attended its various meetings? Have you belonged to the Sunday school or perhaps taught a class? Have

you played the organ or sung in the choir? Have you helped to get money to carry on the church work? It is evident that your idea or meaning of church all depends upon your personal associations, your social participation, the service you have rendered, and much more. The content of general meanings is never a finished product It is always in the process of becoming, of growing

**Relation between language and thought.** We think in words, the word is as closely related to the idea as the skin is to an apple One writer says that ideas are born with their skins on, by which he means that ideas and words possess a very close natural relationship. The idea and the word are as closely connected as the inside and the outside of a saucer It may be that associational thinking, the recalling of images, can take place without words, but in all conceptual thinking and in reasoning through the use of general notions words are an essential. If one really knows anything well, he also knows how to express it, that is, he has the words as well as the ideas The duty of the teacher is to see that words really represent exact ideas to the greatest possible extent in every problem-solving situation. There is always the possibility that words will merely be the substitutes for ideas Children need to be given practice daily in choosing language which will be truly expressive of clear and definite thinking Guidance in the thought processes, in the solution of problems, goes hand in hand with language study Careful analysis of words, sentences, and paragraphs in the school subjects will do much to develop the ability to think clearly. The school should develop a certain respect for words and a sensitiveness to the finer shades of meanings The writer believes that there is a place in the elementary school for a proper study of the principles of grammar, for example, as related to thinking

**Significance of habits and skills.** A large part of the teacher's work consists in the formation of useful habits in the field of character and the development of the necessary skills in those subjects where skills are essential, such as reading, writing,

language, drawing, and several others. We think of neatness, carefulness, cheerfulness, truthtelling as habits, while we speak of skill in skating, in operating a typewriter or a car, in drawing a map, and in telling a story In general, skills involve a number of separate acts or responses each of which must become habituated or automatized in relation to the other movements of the complex skill Learning to write is the formation and fixation of a whole series of responses to a complicated situation Any person over fifty years of age who has really learned to be a skillful driver of a car will appreciate the difficulty of acquiring a complicated set of related reactions If we know the nature of a person's habits, we know the sort of personality or character he possesses Life is worth what our ideals and our habits make it, the teacher has much to do with shaping the ideals and the habits of her pupils The basis of habit is the same as that of memory, namely, changes in nerve cells or tissues of brain and spinal cord. It is a matter of establishing bonds or connections in the synapses between the neurons Professor Romanes once wrote these very true lines

> No change in childhood's early day,
>   No storms that raged, no thought that ran,
> But leaves a track upon the clay,
>   Which slowly hardens into man

Dr. James's famous and classical rules [1] for the formation of a new habit probably have never been excelled "(1) In the acquisition of a new habit, or the leaving off of an old one, we must take care to launch ourselves with as strong and decided an initiative as possible (2) Never suffer an exception to occur till the new habit is securely rooted in your life (3) Seize the very first opportunity to act on every resolution you make and on every emotional prompting you may experience in the direction of the habits you aspire to gain (4) Keep the faculty of effort alive in you by a little gratuitous exercise every day. That is, be systematically ascetic or heroic in little unnecessary

[1] JAMES, WILLIAM—*Psychology, Briefer Course;* Henry Holt and Company.

points, do every day or two something for no other reason than that you would rather not do it, so that when the hour of dire need draws nigh it may find you not unnerved and untrained to stand the test" Every teacher should read the entire chapter on habit in James's text.

The fixing of definite responses involves and requires habituation, drill exercises, and a good percentage of the time of the rural teacher is used in this way It is not the purpose here to detail an analysis of drill procedures It is sufficient to say that the fundamental errors of most teachers are (1) lack of specific aim and (2) a common tendency to make the habituating drill work mechanical rather than intelligent and attentive. The teacher will find it helpful to study Chapter Four in Strayer and Norsworthy's *How to Teach*, on the formation of habits

**Emotional habits and attitudes.** In the work of the school there is a large place for the development of the emotions because of the influence of the emotions or feelings, as we also commonly call them, upon success or failure, and upon happiness or unhappiness Emotions are more complex than feelings Through our feelings we get a sense of the agreeable or the disagreeable, the pleasant or the unpleasant Emotions and feelings are always associated. Emotions include feelings and involve sensations in the bodily organism The teacher should seek not only to have pupils learn the knowledge connected with subject matter but also to develop right mental attitudes American literature can be taught in such a way as to arouse an admiration for the masterpieces and a desire to read them, or the net result may be a lifelong distaste. If the teacher of history has created a liking for historical reading, she has done well Teachers do not commonly think of the mental habits and the emotional attitudes which the school must inevitably develop, whether good or bad; but these are of the greatest importance Facts in themselves have no motive power It is only when subject matter, ideas, are changed over into ideals that they determine human conduct or behavior In teaching

civics every effort should be made to inculcate the useful habits and the right ideals of the good citizen Much health instruction is of little value because it is limited to the teaching of text-book facts

**Learning through free attention.** "Interest is the mother of attention, and attention is the mother of knowledge, if you wish to win the daughter you must secure the mother and the grandmother," said Joseph Cook many years ago. Every good teacher knows that she succeeds best when children apply themselves to their tasks and learn their lessons through free attention born of genuine interest The older psychologist classified attention as voluntary and involuntary Some writers are now using the terms active attention, passive attention, and secondary-passive attention

1 *Active attention* is the attention of effort; one *attends* to a situation because of the determination to accomplish a purpose or to reach a goal Present interests and desires are subordinated to a remoter good

2 *Passive attention* is the effortless surrender to the inherent attractiveness of the present, naturally interesting situation.

3 *Secondary-passive attention* is learned attention which is the result of previous effort, but which now operates automatically through the force of habit and the development of an acquired interest in the object or subject.

The terms *forced* attention and *free* attention have also been used, and the modern idea is that free attention resulting from purposeful problem solving is the kind of attention for which the teacher should strive In the best modern schools free attention is secured through well-motivated activities Active attention is forced attention, passive attention is free attention and involves the least effort because of direct interest, secondary passive attention is the kind in which an indirect interest is developed through learning

Someone has said that consciousness is that indefinable characteristic of mental states which causes us to be aware of them. I know, I know that I know, and I know that I am the knower.

Then I am conscious *And when I am conscious, I must perforce give attention to something* Attention is simply intensified or focalized consciousness The main problem of the teacher is so to direct the program of the school and so to control the child's activities or responses that attention will be centered upon ideas and relations which will contribute to the normal, healthful upbuilding of mind and character A child must attend to something while he is conscious and awake The ingenuity and the skill of his teacher will determine what he shall attend to in school What we are interested in largely determines what we shall attend to, it not only shows what we are, but influences what we are to be Our interest and our interests make us or mar us; a teacher can render no greater service than to see that her pupils acquire as many wholesome interests as possible

**Improving our mental efficiency.** It is entirely possible to improve one's mental efficiency by giving attention to certain fundamental conditions and principles which, for the sake of definiteness and clearness, are here presented in the form of rules or specific directions, as follows

1 It is not possible to give specifications which will apply equally well to every person Individuals differ, working conditions which might be satisfactory to one individual would not be possible or advisable for another whose temperament and capacities were of a different order. However, certain general considerations apply to all

2. Physical health is of course of basic importance, no one can get far in mental work who is, for example, anemic or whose nervous system is below par Every effort should be made to see that the body is well nourished so that there is an adequate stream of good blood flowing to the tissues at all times In general, physiologic needs must be known and suitable means used to meet the demands of the physical organism Nothing can take the place of nervous energy, the daily supply of vital force must be kept at as high a level as possible Many persons, including some teachers, do not seem fully to sense the need for

sound and refreshing sleep during every twenty-four-hour period. In the management of the daily program adequate provision must be made to secure sufficient sleep, for it is the only means of restoring depleted nerve force.

3. Appealing motives and impelling incentives are usually of greater force than external conditions  If anyone has a compelling reason for doing anything, he is much more likely to persist until the task is completed  We do those things which we have a real desire to do, other things being equal. We get what we want if we only want it with sufficient persistence and steadfastness of purpose  Strong inner urges to accomplish results will conquer all sorts of difficulties

4. It is a good plan to arrange for a definite piece of work to be done at a specified time  Many people make the mistake of taking on too light a load  It is advisable carefully to distribute the necessary tasks and to adjust a program of reasonable and possible accomplishment

5 With pupils in school it is of great importance to keep them informed of their progress  If a child can see his curve of successful effort plotted in the form of a graph it will furnish a definite stimulus to work  Pupils should know their grades and teachers should be careful to mark papers which are handed in  A child has a right to know how well he has done his assigned task.

6 In order to work efficiently, emotional disturbances and distractions must be reduced to the minimum. This is largely a question of personal management. Occasions for worry, anger, fear, jealousy, and other destructive emotions should be anticipated and avoided  It is the cool, calm, unhurried worker who does the best and the most work. Uncontrolled emotions tear down and use up large amounts of nervous energy which should be directed into more profitable channels

7. The best workers begin promptly  They do not wait for the precise mood to motivate their efforts  Instead, they take the book and begin to read, or they sit at the desk and begin to write, or they do whatever else needs to be done. There is a

vast amount of waste motion and false motion to be found in delayed beginnings Beginnings are proverbially hard; but after one gets started, the work becomes easier and more effective Any worker can demonstrate this for himself.

8 It pays to develop good working habits The way in which one does his work has much to do with his success and personal satisfaction It is important to have a suitable desk and chair, properly adjusted The books and writing materials should be easily available Before one begins all necessary tools should be procured and made easily available The way in which one outlines his work and distributes his time will have a definite bearing upon the desired outcome. Workers differ greatly, but the most efficient ones are systematic and orderly They have definite objectives and well-considered plans. In this way they are not obliged to do repeatedly what should require only a single doing A study of such a volume as *Learning How to Study and Work Effectively*, by W F Book, will be of real help to the young student

9. No task will be long continued or successfully conquered if there is a total lack of interest But interest is not something brought down from the sky or plucked from the air Interest is developed by finding interesting qualities or aspects in the job When a student gets attuned to his work, he will develop increasing interest in it We acquire interest as we discover new and interesting phases of whatever we are doing Thus interest is a complex result of the successful personal fitting or relating of oneself to his work To acquire a motivating interest in the task is the aim of every competent worker, in school or out; but this can come about only by a continuing series of personal adjustments to the task as it assumes different aspects in progress toward the goal

10 The working program should be varied As a rule it is better not to continue with one type of work after it becomes exceedingly laborious or fatiguing In this respect also people differ markedly Some wish to continue in spite of all difficulties until the work is completed Others do better to come back

after a change of activity Each person must solve his own problems In school work a diversity of tasks properly distributed produces the best results Intervals of rest should follow periods of work

11 Each of us has his own likes and dislikes, his own personal inclinations and disinclinations In this matter of efficient performance any worker will do well not to consult his own personal whims too much In order to forge ahead, it is necessary to ignore many relatively trivial deflecting tendencies Through effort one can overcome most of the disinclinations which retard progress In school work the teacher should make all working conditions as favorable as possible and then encourage pupils to direct their activities toward the chosen ends regardless of the personal discomfort or dislike of the moment.

12 As the result of many experimental studies it has been found that the better plan is to go through the entire lesson material several times to get the relation of the parts and then to give special attention to the more difficult portions Efforts should be made to recall at intervals, reviews should be given at increasingly long intervals—one day, one week, one month, six months The teacher should call attention to related meanings rather than to words Organizing the materials into logically related units is of much value in learning

## REVIEW, TEST, AND PROBLEM EXERCISES

1. What is the fundamental thesis of the behavioristic or objective psychology and how does it differ from the belief of the purposive philosophers?

2. Discuss the relative influence of heredity and environment. What determining factors in personality are fixed by heredity?

3 Just what did Pavlov contribute to the learning process by his discovery of the conditioned response?

4. What is the relation between language and thought?

5. Indicate some emotional habits which a teacher should try to form and fix and others which should be avoided, if possible

6 What can a rural teacher do in the field of mental hygiene for herself and for her pupils?

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## CHAPTER XVI

## HOW WE LEARN

**We acquire a great variety of behavior responses.** The distinguishing characteristic which places man far above all other animals is his capacity for learning new ideas and new ways of acting Although men differ greatly in their ability to learn, the average person is able to learn a great deal in his journey from the cradle to the grave. He learns the conventional behavior of the society in which he finds himself, that is to say, he learns the approved social usages He learns how to behave in the home, in church, in the club, on the street, at the theater, on the train, at the dance, and on the golf links He learns to use the conventional language He learns how to carry on a conversation, and he learns to speak before an audience He frequently learns to sing and to play a musical instrument He may learn to dance, to swim, to skate, to typewrite, to ride a bicycle, to drive a car, to plan his work carefully. He may or he may not learn a good set of emotional habits. He may learn to worry, or he may learn to be cool, calm, poised, serene He may learn to be afraid, or he may develop habits of courage and fortitude He may acquire good posture habits, or he may not He may learn how to select and to eat his food properly, or he may not He may be a good sport, or he may be selfish and want things to go only his way He may learn to be a good reader, writer, and speller, or he may have only poor ability in these subjects

**Nature of the learning process.** How did you learn to play "one-old-cat"? You answer that you learned to play the game by playing it, and that is the truth of the matter, for the most part However, some learn to play a good game and some never get to be very proficient. Players differ in their learning capacities They differ in both their physical and their mental

make-up Of course no one would learn to play this pleasing game by merely reading the rules in the chapter on play in this book But one must know the rules, probably the best way to learn them is by degrees, day by day, as the playing goes on. In this game the rules are few, simple, and easy to learn In any case of learning we always find a situation or stimulus more or less complex, to which there must be a reaction or response if any learning is to take place. The psychologist represents this learning process by the symbol S → R, in which we have S for situation, R for response, and the arrow for the bond or connection between them As one learns to play the ball game, the various responses to the different associated situations tend to become co-ordinated, mechanized, and fixed In the case of ball playing, the learning goes on readily and effectively because the child has a desire and a satisfaction in the exercise or in making the various necessary repetitions He is interested and the learning is thus well motivated There is the social stimulus here also In learning school subjects, interest and motivation are often lacking

**Why is learning necessary?** Learning is necessary because new situations are constantly arising in the lives of most persons which require new adjustments and adaptations if the individual is to satisfy his wants and rise to higher levels To be sure, there are some persons who do not care to learn, but this book is not written for such people In most cases the situation is met by the use of habitual responses, but when habit is not enough, then the situation will require and provoke thought It will then be a case of thinking and of problem solving, of course there are plenty of people who cannot or will not do much thinking Effective thinking is not easy, many do not care to take the necessary time and pains. It is probably true that the average person is also quite incapable of doing a great deal of *real* thinking A rural teacher can hardly go through with the work of a day without learning something, perhaps a good deal She will learn new things about her housekeeping, her management of the pupils, her teaching of geography, arithmetic, or spelling She will learn better how to adjust herself to difficult pupil personal-

ities, she will learn how to get more satisfactions out of her boarding place; she will learn how to secure from the school board the needful equipment for the school Learning is necessary because life is a succession of difficulties and problems

**What can we learn?** Probably most people think of the school, of teaching, and of learning as related to subject matter. The common view of school learning, at any rate, is limited largely to a mastery of the textbook materials which are to be learned and recited to the teacher This is of course a pitifully inadequate idea of the nature and the net results of learning In the broadest sense what we all need to learn is how to live; how to adjust ourselves to this social world; how to provide by suitable, effective, and productive labor for our various wants We all need a great variety of knowledge and of skills We need ideas, and we need ideals to motivate our conduct We should learn life-giving ways of enjoyment If we are to make the most of life, we need to learn how to appreciate good music and beautiful pictures We must also learn how to understand and make the most of nature We need not only to learn to read, but we should also have good habits of reading to learn Moreover, in the field of reading, for the greatest culture and enjoyment we require a somewhat extended range of tastes in various departments of literature We can acquire the habits of the good citizen, and we can also learn the ideals involved in good citizenship We can know many useful facts in the realm of human physiology, but such knowledge is of little avail unless we have a good set of health habits We learn ideas, ideals, and habits. Knowledge alone will not save us to a life of usefulness and satisfaction We need also to learn and to fix a great many responses so that they become automatic and controlling Our emotional control and poise, our skill in doing a great many things, our ability to provide for our legitimate desires, our attitudes toward others and toward life itself—all this and much more can be learned and is of the greatest importance

**When have we learned?** When have you learned to spell *grammar?* When have you learned to read well orally? Silently?

When have you learned to swim? To skate? When have you learned Bryant's "To a Waterfowl"? When have you learned to write well? When has a fifth-grade pupil learned to be a good speller on a fifth-grade level? A good reader and writer on the same level? When have you learned how to point off the quotient in division of decimals? When have you learned good table manners? When have you learned to speak before an audience? Some of these questions are easy and some are very difficult It is one thing to learn how to spell *privilege*, but it is an entirely different thing to learn to appreciate the beauty of Tennyson's "Bugle Song," or Breton's "Song of the Lark," or the "Perfect Day" by Carrie Jacobs Bond To learn that 7 times 9 are 63 is one type of learning, but to learn how to solve problems involving the fundamental rules is an entirely different matter One answer to the topic question is that we have learned when we know the fact "for keeps," or when we have acquired the skill in its entirety and perfection No one has learned to drive a car until all the movements are entirely automatic To this should be added that ability to drive a car requires also a desire to obey the rules of the road and the habit of obeying them We have learned when we know and *can* and *will* do, although in some learnings there are various levels of knowing and doing, according to age, intelligence, and special ability of the learner In the realm of appreciations there are many grades of attainment There is a profound difference between knowing the facts of geography and the ability to use this geographical knowledge in solving economic and industrial problems. We have learned when we know accurately and can do skillfully

We have learned the controls of conduct when they operate without much conscious effort, when they have become automatic We speak the truth habitually because we believe in truthtelling as necessary to social integrity and because the attitude and the habit are quite fixed in our lives We have learned both the attitude and the habit. We have learned to pay our bills promptly only when we do so at regular intervals

without failure or omission, and because of an inner habitual prompting. If we "go off the handle" every now and then, we surely have not learned poise and self-control. Some lessons are very hard for children and grown-ups to learn. Learning the capitals of the states is easy compared with learning the habits of friendliness, cheerfulness, fearlessness, good nature, courtesy, poise, and many other vital personality habits. Too often the school leaves essential character ideals and habits to chance and to concomitant or incidental learning.

**Neural mechanism essential.** When we say that there is "no psychosis without neurosis" we mean essentially that every response to every situation involves some change in neuron, or nerve cell, in synapse, or, in general, in the central nervous system. Reuben Post Halleck many years ago wrote a suggestive and valuable book entitled *Education of the Central Nervous System*. The fact of the matter is that all learning involves changes in nerve tissue and would be impossible without such changes. The sensory neurons receive the nerve impulses from the nerve ends of the sense organs and transmit them inward to the central nervous system. The motor neurons carry these stimulations from nerve centers to muscular tissues. Between the sensory and the motor neurons are found the connecting or associating neurons. This entire marvelous mechanism is of such a nature that, in the process of learning, the physical stimulus in the outer world causes a physiological stimulus in sense organs and sensory nerves which in turn is reflected back by nerve centers of the central nervous system. Through sensation and perception we secure the raw materials for learning. No learning ever occurs without the stimulus, connecting bond, and response accompaniment. From the standpoint of learning perhaps the synapse is the most important neurological element. Some essential change takes place when the resistance between the neurons at the synapse is overcome in the process of learning.

**Mechanistic view of learning.** Since all learning evidently involves stimulus, nerve connection, and response, it is quite

easy to take a materialistic, mechanistic view of learning and to believe that a child is nothing more than a reacting nervous mechanism, from the standpoint of learning. Experiments on the lower animals seem to have led many psychologists to become thoroughgoing behaviorists. However, there are many students who believe that learning includes certain essential elements which cannot be wholly explained on physical, behavioristic grounds alone. For example, much learning seems to involve *purpose* which is difficult or impossible to explain as a purely objective element of the learning process. There seems to be a mental element in all learning which the behaviorist school of thinkers would have us believe is nonexistent. Today there is a pronounced tendency to classify psychology with the biological sciences; man is nothing more than a physiological machine, according to the behaviorists, without a mind as we have always thought of mind. The present writer believes that in human learning we find the active working of desires, emotions, inner urges, and purposes which are of a nonmaterialistic nature. Human beings set up objectives or goals; moreover, there are driving impulses, something akin to a will to learn when it is present or can be aroused.

**Elements in the learning process.** The writer has vivid recollections of learning to skate, to ride a bicycle, to drive a team of horses, to drive a car, and to perform other acts, particularly those on the farm. How do these informal, out-of-school learnings occur? There seem to be at least four elements in the process, as suggested to the writer by Dr. Lois Coffey Mossman in her very informing and helpful book on teaching and learning.[1] In learning to skate there were first the facts that the other schoolboys were skating, that there were excellent fields of ice on the marshes, and that there was a pair of skates in the farm home. The boy had seen others skate. He *saw* how it was done. In the second place, there was the boy's desire to do things on his own account. He wished to skate as

[1] MOSSMAN, LOIS COFFEY—*Principles of Teaching and Learning in the Elementary School*, Houghton Mifflin Company. 1929.

well as Albert or Fred The boy was young and was encouraged to act, to do, by his social environment. Third, it was very gratifying, indeed, after numerous hard falls and knocks, to be able to sail over the ice, to cut circles, and to race with the other boys It was a great personal pleasure to be able to control his movements on the slender strips of steel He became a good skater and he was proud of it He could do what the others did. He had achieved, conquered, learned Last, there was added to his life equipment another important skill which he could exercise when occasion offered So here we have the· (1) stimulation, (2) desire, (3) motivation, (4) resultant new desired accomplishment

**Formal and informal learnings.** As has already been pointed out, a large part of the learnings of practically every person has not been acquired in the school. The learnings of the school are often exceedingly formal and bear no relationship to the situations confronting children outside of school in the social world. Children learn so many things in school that do not function in real living The informal and often incidental learnings of experience often have the greatest value in the development of ideas, ideals, and habits Many of the skills and abilities learned in the home, on the farm, in play, in connection with club work, in various young peoples' organizations, and in many other ways belong to the class of informal learnings and have a direct bearing upon successful, happy living A generation or more ago there were greater opportunities for the informal learnings through experience. Children helped to make butter, to bake bread, to can fruits and vegetables; still earlier they assisted with the spinning, the weaving, the making of candles, and in many other ways Most of this has passed away. When there was a cow, a horse, and some pigs to take care of, the boy learned how to do many things The everlasting chores constituted a real course in education Today the child is learning, for better or for worse, from the radio, from motion pictures, from the daily paper, including that collection of commonly useless miscellany, the Sunday edition Today the school must offer many

substitute opportunities for learning, to take the place of those which were formerly found in the home or on the farm

**Intentional and coincident learnings.** Many teachers give but little attention to what their pupils are learning incidentally and accidentally in connection with and as a part of the regular lessons and direct instruction of the school. The formal recitation may be so conducted as to develop habits of attention or inattention, of carefulness and accuracy or of carelessness and guessing or "stabbing" at the truth The teacher should realize that the child's mind is not inactive He is always thinking of something; he is forming ideals and attitudes which may make or mar him for life When the pupil is engaged with his history lesson, what opinions is he forming, what judgments is he making concerning the justness or the unjustness of the moral situations involved? The teacher intentionally teaches children to write, but what attitudes is she developing in the preparation of written papers to hand in for inspection? A teacher who understands the complex nature of the child will be particular about the incidental, concomitant, and accessory learnings which are going on in her school. Is the child acquiring respect for public property? Is he learning to speak out clearly and distinctly? Is he securing good habits of posture in sitting, standing, and walking? Some teachers are so concerned with the teaching and learning of book subject matter that they forget about the unconscious but extremely important development of character which is going on from day to day It may easily be true that many of the concomitant learnings of the school are far more important than some of the regular lessons.

**Learning and behavior or conduct.** When we really learn anything, we are different from what we were before we learned. The acid test of learning is whether or not it changes behavior or conduct This is obvious enough with some learnings, but it is not so clear in other cases. When one has learned to play tennis or golf, very evidently there is an addition to the behavior complex When a person acquires a new skill or set of skills, he is a different person to that extent and will henceforth behave dif-

ferently in certain respects In the arts of the school, such as that of ability to read well silently on, let us say, an eighth-grade level, we have an illustration of the decided change in behavior When the silent-reading skills are mastered, the individual will be a changed person for the rest of his life But in a lesser way and on a smaller scale, when a pupil has learned the difference between simple, complex, and compound sentences, his behavior in the field of sentence structure is not what it was before He now has new standards, and he will in future react differently in the composition and comprehension of sentences What change in conduct takes place when anyone learns Lincoln's "Gettysburg Address"? If learning here means merely committing words to memory unthinkingly, not much has been learned But if there can be some understanding and appreciation of the nobility and majesty of the thought, of its deep significance and its broad charity, and of the beauty and grandeur of the simple style—if these learnings take place, forevermore will the learning student be changed and different. His views, his ideas and ideals of life and human relationships acquired in such a study will inevitably change his life In short, he will behave differently because of his contact with a great soul.

**Factor of experience in learning.** By the term *experience* is meant some contact with and reaction to the environment, some response to a situation of varying degrees of complexity It is correct and safe to say that no learning can take place without the personal experience of the learner. The learner must react or respond The law of self-activity is basic and controlling It is self-evident, however, that there is a vast amount of experience which the race has acquired and recorded on the printed page, which the individual could not possibly learn by direct personal experience What can be done to pass on such a mass of ideas? Through skillful teaching the learner must go through the process of re-experiencing what others have experienced. This means that the learning pupil will interpret the ideas which he finds in books in terms of his own experience. It is the duty of the teacher to see that the child really under-

stands the related meanings which he encounters The chief fault of the traditional school of the past was its emphasis upon a reproduction of lifeless symbols, rather than upon a rethinking of vital and vitalizing ideas and meanings In the more progressive schools provision is made for a great variety of social experiences In such schools children actually learn ideas, ideals, and skills by real living experiences In the very large majority of rural schools only the most meager and entirely inadequate provision is made for important, first-hand learning experiences Such experiences are conspicuously absent

**Intelligent, purposeful, meaningful learning.** These adjectives are used in contrast to stupid, lifeless, aimless, verbal learning The chief objective of the school is to promote genuine learning In connection with any lesson the teacher should be continually asking herself what the children are learning and how they are learning Today we have such an abundance of materials to further true learning that any teacher with proper motives and true educational objectives will be able to find and to use them The modern textbook is a truly wonderful means to stimulate and guide the child in his quest for knowledge and power Every procedure of the school should be infused with thought, purpose, and meaning This is true even of the drill procedures All drills should be well motivated, which means that the learner will see meaning and purpose for himself, personally, in his repetitions When learnings take place in real natural social situations, when the child is learning because he is living, then there will be intelligence, purpose, and meaning; otherwise not No teacher today needs to be guilty of teaching meaningless symbols or of presenting mere verbal husks or shells instead of nourishing, life-giving activities

**Learning should be motivated.** In *An Introduction to Teaching and Learning*, by Yoakam and Simpson, the authors discuss motivation of the assignment, motivation of study, motivation of diagnostic and of remedial teaching; motivation of drills, reviews, and tests; motivation of motor, observational, and creative learning; motivation of the appreciation lesson, of story-

telling, of dramatic activities, and so on When we have had the real experiences in actual living, our learning is likely to be motivated, particularly if we have personal problems to solve or genuine purposes to realize The school program of learning should include problems and purposes to as great an extent as possible We all learn best when we desire to learn. One of the chief criticisms of the traditional school is found in this particular field The formal aimless drill procedures were almost wholly lacking in motive It is now generally agreed that in the shaping and fixing of habits and skills, every effort should be made to furnish sufficient reasons and to arouse a desire for mastery and perfection The boy or the girl will learn readily enough to drive a car because of the impelling motive which is involved and which overcomes all obstacles This is always true of any habit or skill in which the inner driving force impels the learner to make every effort toward accomplishment of the coveted objective In problem solving the same principle governs If the boy wishes to build a boat or a birdhouse, or to make a kite or an airplane, or to go fishing or camping, he will take great pains and he will work hard to solve the various problems involved in the project The great argument for the use of problems and projects in school work and for the much criticized activity program is that in their use we have the natural setting and the motivation involved in real, personally worth-while, and purposeful living experiences The principle of motivation is fundamental and basic in all teaching and learning procedures

**The willing attitude in learning.** We often speak of the will to learn or the will to work. This simply means the inner urge, desire, or purpose which in themselves are the complex products of learning One of the most important duties of the teacher is to develop this sort of a spirit and willingness to learn by suitable teaching and learning procedures. Learning cannot be forced "You can lead a horse to water, but you cannot make him drink" He will drink only if he has the thirst. One of the great functions of the school is to develop special thirsts for particular learnings Pupils will differ greatly in the nature and degree of

the inner urges, but after all they are matters of development. If teachers would spend far more time than they often now do in arousing and stimulating new desires and ambitions, the work of learning would be carried on with far greater effectiveness. In particular, the attitude of willingness to learn has reference to the special lesson of the hour. In all subjects and lessons of whatever nature the teacher will find that time and effort used in securing special interests as related to special topics will pay real dividends in better work and learning. The resources of the school and of the environment are frequently overlooked and not used. The use of objects, pictures, bulletins, reference books, maps, workbooks, charts, and the like helps greatly in the development of ideas and attitudes which stimulate effort and accomplishment. The willing attitude is not a fixed quantity plucked from the atmosphere. It is itself a developed complex of ideas, ideals, and habits. One of the chief functions of the teacher is to have her pupils develop the willing attitude as a part of the total learning process. The learning attitude may be of far greater significance than the knowledge acquired.

**Hit-or-miss learning.** Have you ever tried to work out a puzzle or to discover the secret of some toy mechanism when you had had no experience with anything of the sort? You did not know where to start or what to do. Your efforts were aimless and random. You tried first one way and then another until finally you may or you may not have hit upon the solution. If you did solve the problem, it was wholly by accident. You had no previous learnings to guide your efforts. Of course this trial-and-error procedure is a wasteful learning process. It is the way the cat or the rat finds the way out of the maze. While it is entirely legitimate for boys and girls to work out puzzles on their own account without outside guidance or direction, we shall agree that this type of learning takes too much time and effort to be very useful in the work of the school. The teacher needs to guide and direct the process so as to save the child from useless effort. There is, of course, always a place for the child to experiment for and by himself; he should be given repeated

chances to do so. A wholesome interest and curiosity about puzzles and problems is a healthy sign and should be encouraged. The rat and the cat are forced to the trial-and-error method because they cannot think and because their capacity for imagery is exceedingly limited. Children are able to profit by experience through the power of remembered ideas and ways of doing things. When confronted by a new situation, the child can learn to apply what he now knows and can do, so that the problem is solved with greater ease and economy of time.

**Profiting by one's mistakes.** The president of a great state university was negotiating with a man whom he had asked to take an important position in the institution. The prospective incumbent of the office expressed some misgivings relative to the perfect discharge of his responsibilities, at least in the beginning, and stated that he would possibly make a good many mistakes. The president replied that he was not unwilling that some mistakes should occur, and stated that such errors were incidents in the work of the office. However, he made it plain that he would not look with so much favor upon a repetition of mistakes. It turned out that the new official was keen and ready to learn. No doubt he did not do everything exactly right, but he studied not to commit the same error the second time. He has been in this position for several years; it is generally conceded that he has done very well, indeed. Children should be taught to profit by their mistakes. If they are really to learn, they cannot keep making the same mistakes over and over again. Pupils of average intelligence can learn the lesson that their progress is determined very largely by their willingness to let experience be their teacher. The lower the grade of mentality, the more difficult it is to learn the lessons of the school and the lessons of life. There are plenty of people who do not get ahead because either they cannot or they will not learn the lessons of experience. They keep in the same old way in spite of their very evident inefficiency. As much as possible, mistakes should be avoided through careful planning and attention to details.

**Learning actions and learning ideas.** Another way of wording this topic is *learning to do* and *learning to think,* or possibly motor learning and associational learning. Whether we learn modes of overt action or whether we learn through observation or by associative memory, imagination, or thinking processes, we are learning to behave differently. We are modifying conduct or behavior. Thinking is merely a form of inner behavior. If we learn to appreciate the "Angelus" or if we learn to tell or to write an original story, we are learning ideas and ways of behavior. When one has learned about the home life of the early western pioneers the result is a group of related or associated ideas. In such learning, action or doing may also be involved in the use of various project activities. When we learn actions, we are also truly learning the ideas that belong to the varied responses. Actions may be simple or very complicated. Learning to pronounce a word, to draw a circle, or to spell a word orally or by writing it calls for a simple response. Learning to build a bird-house involves many actions in carrying out the ideas or the images which lie back of the material realization.

Actions, motor habits, skills, are usually best learned when the learner understands the meaning of what he is doing. It also often happens that meanings are made clear through the use of muscular movements by way of illustration. In the kindergarten and in schools making large use of activities and projects we find many illustrations in the daily program of the relation between motor learning and the learning of meanings through the principle of association. In this discussion the term ideas includes all meanings as found in general notions, images, and percepts. Learning ideas and learning actions should not be thought of as in contrast but rather in the nature of being complementary, mutually interdependent, and re-enforcing. The more associations and interactions the teacher can establish the more fertile, useful, and permanent will be the learnings. In the use of the Montessori method we find an excellent illustration of the relation between physical activity and the learning of a great variety of fundamental meanings. This system was de-

vised by Maria Montessori of Italy for the education of small children and is based upon the same principle as that of the activities curriculum in this country

**Rote learning vs. rational learning.** Let us give attention in another connection and from another point of view to the great significance of what we may designate as false learning in comparison with true learning The distinctive work of true learning is that it changes the individual's behavior. Not all rote learning is necessarily false learning, but the memorizing of meaningless words or materials in almost any form is comparatively useless Rote learning was very common in the old traditional school In this connection it should be noted that to store the memories of children with many useful facts is one of the functions of the school Literary selections, both prose and poetry, committed to memory, will usually prove a great mental resource in adult years Undoubtedly some things should be learned by heart and for permanent retention Pupils should not be required to commit to memory meaningless dates, names, and events. The value always lies in the associated meanings Usefulness and relevancy should always be considered Today rational learning is found at its best in those schools which make a rational use of problem solving, projects, and activities However, even drill exercises can be rationalized by stressing purposes, meanings, reasons, and motives.

At one time it was the practice to distinguish between rote studies and rational studies There is no such distinction All learning can and should be rationalized In teaching such subjects as geography, history, physiology, civics, agriculture, and the like, there is ever-present opportunity to use rational procedures by the use of problems, projects, and activities The verbatim reproduction of textual material should be literally taboo. It is a complete waste of time and energy, an utter farce, which should no longer be tolerated By the use of modern forms of assignment, by means of socialized discussions, by changing the purposes and practices of the recitation, by carefully directing the pupil's study activities, by the use of high-

grade workbooks, and in many other ways learning can be increasingly rationalized, even in the country school There will always be a place for repetition, for memorization, for drill, but these should always be intelligent, purposeful, meaningful, and rational

**Learning as memorization** Every teacher should read Chapter seven in *How to Study and Teaching How to Study*, by F M McMurry [1] The title of this chapter is "Memorizing as a Fifth Factor in Study" The entire book is a genuine educational classic Dr McMurry makes a large contribution to more rational teaching-learning procedures chiefly through insistence upon the value of purposeful thinking His illustrations are pertinent and suggestive Every chapter in this famous book reflects the knowledge and skill of a great teacher

Today there is a marked tendency not to stress memorization as an end in itself, but rather to find a place for memorizing as a learning activity which should be utilized when occasion demands, that is, when there is a natural need for this phase of learning In conducting purposeful, problem-solving activities certain elements of the situation require permanent retention. Then is the time to memorize, when the motive is strong In adult living we memorize only when we are obliged to do so, that is, when purpose and desire are both impelling

It is now a generally accepted principle that in the memorization of poetry time spent upon getting a thorough understanding of the related meanings of the entire unit is of the greatest value In learning poetic selections the good teacher at the present time is very particular to give needful guidance and direction from the start, so that wrong images and ideas are not formed by the children First impressions are often difficult to eradicate By repeatedly going through the entire selection during a carefully conducted study-recitation with particular attention to understanding and appreciation, the work of memorizing will be considerably lessened Trying to learn a literary unit piece by piece is entirely the wrong way to do it

[1] F M McMurry—*How to Study and Teaching How to Study*, Houghton Mifflin Company 1909

Memorization is only one of many elements of the learning process, which includes observation, skill and habit formation, problem solving or thinking, appreciation, and so on Memorizing has a most important place as a necessary form of learning, but it was formerly given an entirely illogical prominence; even today its use by some teachers is out of all proportion to its importance

**Learning as problem solving.** It seems to be pretty generally agreed today that problem solving is the most important of all forms of learning activities It is man's ability to solve problems which has given him his present position in the world. Through thinking, human needs have multiplied enormously during the ages, man's desires and wants have been satisfied by his power to use reason in the solution of his problems Other forms of learning, such as observation and memorization, make their contribution to the thinking or reasoning processes In solving any problem the first step is the gathering of data We cannot think without a stock of images and ideas Pupils should be guided and directed in their efforts to accumulate materials to be used in their problem-solving thinking It is the planning, the evaluating, the use of critical judgment, and the attempt to classify and organize which make problem solving so valuable for boys and girls They must be guided to withhold judgment until they possess the necessary facts In classes in history, geography, physiology, agriculture, civics, and other subjects there is daily opportunity for using discussion periods in which this type of learning receives much attention After considerable guidance in group activities, pupils will be able to work on problems by themselves Some teachers take great delight in problem-solving exercises because they themselves enjoy thinking, whereas other teachers find lessons involving thinking more or less disagreeable and unsatisfactory Some teachers include many problem questions in their assignments, while others find this quite difficult and prefer asking questions calling for textbook facts If the school can offer personally interesting and profitable problems to boys and girls in which at-

tractive goals are set up, the question of motivation will be settled

**Learning and subject matter.** As a result of her course in the training institution, the young beginning teacher should clearly understand the function of subject matter She should realize that her chief business as a teacher is to guide and direct her children so that they will learn Learn what? Learn subject matter? No Learn ideas, ideals, habits, skills, attitudes, appreciations The function of subject matter is to further this real learning Subject matter is found everywhere in nature, in books of all kinds, in magazines and newspapers, in the radio, and in scores of other places. When the pupils acquire ideas, skills, attitudes, and the like, they are really getting new ways of behaving which their experiences give them If the materials of textbooks do not bring about changes in the inner or outer behavior of the pupils, they are inert and valueless. Children do not go to school primarily to learn the facts of the curriculum They go to school in order that their behavior in all ways may be changed for the better through the use of or by means of all the various types of subject matter Even a little thought will convince anyone that over fifty per cent of the efforts of the school are wasted so far as any real influence of the subject matter upon the lives of the pupils is concerned It is the atmosphere and the system of the good school, including the influence of a teacher of good personality, which really change the characters of boys and girls the most To be sure, they learn to spell, to read, to write, to compute with numbers, to use oral and written language, to recite poetry, to bound the states, and to give the powers of Congress, but over and beyond all this the vital question is what kind of boys and girls are they becoming? Subject matter *can* be used to change the lives of the pupils, but the procedure is not a deadly, memoriter, rote type of learning Dr Mossman[1] says: "To one who looks upon subject matter as the behavior-patterns of controls learned in

[1] *Teaching and Learning in the Elementary School,* Houghton Mifflin Company

experience, subject matter is continuously being learned Whenever the child is doing something, he is learning that which modifies his further behavior "

**" Overlearning " and its value.** Probably few teachers understand the need for learning beyond the point of barely knowing or of just being able to go through the motions It is now well known from experimental studies that if anyone is to retain ideas or motor skills it is necessary to "overlearn" them Too much of school learning is merely for recitation purposes or for the passing of tests or the satisfying of the teacher Pupils and students in the grades, in high school, and in college often seem satisfied to just "get by." They are not ambitious to master their learnings for permanent results either in the field of purely intellectual studies or in the field of the various important skills where perfection of execution marks the exceptional performer. There is indeed a significant and serious fallacy in the "passing grade" If "insightful learning" is carried to the point suggested in Morrison's Mastery Formula where related meanings are learned "for life," the changes in the attitudes of the learner would indicate a real modification of personality Every teacher should select certain portions of subject matter to be learned so thoroughly that they will never be forgotten The good teacher develops a pride in mastery Morrison's Mastery Formula is this "Pretest, teach, test the result, adapt procedure, teach and test again to the point of actual learning " Most of what is learned in school is forgotten, but if there were more use of overlearning and greater practice in harmony with the Morrison Mastery Formula, more would be retained and behavior would be more greatly influenced.

**Individual variations in learning.** Individual differences are considered in Chapter XVIII. It is sufficient to point out here that the pupils in any given grade range in ability all the way from those who are definitely dull and slow to those who are classed as bright. The dull, slow pupils have great difficulty in learning the same lessons that the bright pupils master with ease. Probably most of the children in a room of, say, forty will have

I Q.'s somewhere between 90 and 110 There are generally a few who are subnormal and about an equal number above normal The larger and more mixed the group the truer this will be The causes of differences in learning capacities are found in heredity and environment, the effect of the two influences varies according to individuals No doubt inheritance has greater weight in the matter of intelligence than anything else If a child is "born short" in native endowment no amount of education will ever be able to overcome the deficiencies However, environment, by which we mean every sort of educational influence, is a powerful force, it is surprising what can be done through long continued, skillful teaching-learning procedures In recent years much attention has been given to the problem of individual differences, in the best schools instruction is adapted to the differing capacities and needs of pupils much more than formerly It is the duty of the teacher to find out why a child is not learning or why he is making poor progress A pupil may be a good reader but a poor speller, or the reverse Why is that? It can be found out today by diagnostic tests A child who is undernourished, or who does not sleep enough, or who for any reason is below par physically cannot learn normally Sometimes lack of progress is due to the attitude of the family There is no encouraging home influence to make the child ambitious. Whatever the cause, whether heredity, health, or something else, it can and should be discovered

**Teaching an old dog new tricks.** It is a common saying that you cannot teach an old dog new tricks, the implication usually is that learning is largely for children and young people This is an example of one of those traditional beliefs which are hard to down Some experimentation has been carried on with animals, and Thorndike has done a good deal of work to discover the effect of age upon the learning of adults. His book on *Adult Learning* gives the results of his researches It has been found that adults can learn very well indeed A normal adult of forty can learn about as well as a child of sixteen The adult may be handicapped by preconceived notions and by a number of in-

hibiting habits, but he may have the advantage of greater interest and better methods of work Adult men and women are able to learn without great difficulty during the thirties, forties, and fifties, it is not uncommon to find people learning in their sixties and seventies Many a man and many a woman has learned to operate a car or a typewriter after even the three score and ten supposed limit Of course that is exceptional But today adult education has come to stay, in the future it will be entirely possible for men and women to continue their education as long as they desire The "Moonlight Schools" of Kentucky and the night schools in practically every state demonstrate beyond question that adults can learn what they greatly desire to learn In a country like ours, with constantly changing social, economic, industrial, and civic conditions, it is highly desirable that adults continue the learning process by means of evening schools, correspondence schools, and other agencies This objective will most certainly be realized.

**Law of readiness.** In a chapter on the learning process it is hardly possible to omit some consideration of the three laws of learning now generally accepted by school people as valid and pertinent The laws of *readiness*, of *exercise*, and of *effect* were first formulated by Dr Thorndike as a result of animal experimentation The law of exercise is also called the law of use The law of disuse is of course as important as the law of use and is sometimes stated as a separate law

*Readiness* has reference mostly to one's special attitude at a particular time, because of present knowledge and experience, towards any act of learning or any form of behavior or reaction If one has just finished a full meal, he is certainly not ready to eat If one has been practicing jumping for some time, he will be more ready for rowing or for sitting down and resting

If a pupil has been committing poetry to memory for thirty or forty minutes, he would probably welcome a change to a spelling exercise, to writing, or to some work in arithmetic If a person is not ready to act or learn in a certain way, efforts to force the learning displease, irritate, and interfere with learning When a

pupil is already set for any form of learning and is not allowed to act, the result is an interference with his learning processes. Fatigue decreases readiness and rest restores it "The general attitude of the learner, his store of ideas, his acquired skills, his habits of thought and action, his feelings, all have to do with the individual's readiness to act"[1] In teaching and learning, the chief consideration is whether or not a pupil is ready because of his present physical and mental condition and because of his previous learning experience for whatever is new and now to be learned

This law of readiness has reference to the individual's desire, willingness, or ability to learn or to do some particular thing at some particular time However, the teacher should not understand that she is to accommodate herself to a pupil's whims and caprices Often a pupil must do what he does not want to do, or to do just then at any rate The teacher must develop a condition of readiness by suitable teaching or suitable motivation Maintain a normal mental fitness by attention to good sanitation and hygiene and by securing a wholesome learning attitude and emotional tone Remember that there is no such thing as general readiness Readiness has reference to the condition of an individual at a given time as related to some specific situation A boy may not be ready to learn addition of fractions of unlike denominators because he cannot reduce fractions to a common denominator

**Law of exercise.** In its general implications, the law of exercise is perfectly obvious, it is the one law of learning which has always been recognized and emphasized It is equally plain that mere repetition does not insure learning The repetition that counts is intelligent, insightful, purposeful, attentive repetition The law of exercise applies not only to the learning of skills and habits but to any form of learning. Mechanical, aimless, lifeless repetition may not result in any useful learning According to the Gestalt school of psychology, "repetition has

[1] LOWTH, F J.—*The Country Teacher at Work,* The Macmillan Company, 1930

the same place in learning that time has in growth. Repetition does not explain learning; it gives opportunity for learning to take place" According to Ragsdale,[1] "The factors which really explain learning are such things as the character of the goal, the time interval between repetitions, the learner's own level of insight, incentives, distractions, rhythm, method of procedure, etc" The correlative of use is disuse If use is basic in learning, in remembering, then disuse is the way of forgetting. However, some things, once learned, are never forgotten. It is much easier to forget how to demonstrate the Pythagorean proposition than it is to forget how to swim. If you once learn to swim or skate well, it will never be forgotten *Other things being equal,* the greater the number of times one reacts or responds to a situation the better the learning.

**The law of effect.** In stating the law of effect, Thorndike originally used the terms "satisfaction" and "annoyance" The law of effect was formulated to explain why some repetitions promote learning and others do not Some psychologists, notably the behaviorists, seem to think that the law of exercise explains all learning However, the law of effect seems to be not only very reasonable, but from the standpoint of the teacher, the most important of the three. Here is one statement mostly in biological terms as given by Gates [2] "Individuals tend to repeat those reactions which, on the whole, are satisfying, whereas they tend to avoid, and therefore to fail to repeat, those reactions which, on the whole, are annoying" Individuals are either animals or persons At the present time there is a tendency to criticize the terms *satisfaction* and *annoyance* The critics would describe the law of effect in terms of conditioned responses or simultaneous stimulation This would give the law a purely objective character So far as teaching and learning in school are concerned, the law of effect is this. Make all of the child's learning as pleasing, happy, satisfying as possible Set up

[1] RAGSDALE, C E—*Modern Psychologies and Education,* The Macmillan Company 1932

[2] GATES, A I—*Psychology for Students of Education,* The Macmillan Company 1930

attractive, attainable goals Teach children to be interested in their own attainments and progress by the use of graphs and other means Remove disagreeable accompaniments from the learning process as much as possible Do not associate learning with punishment or with the painful In short, see to it that the child really desires to make the necessary repetitions or to give attention to any other learning activity

**The learning curve and its plateaus.** Many years ago before modern objective measurements came into use, several investigators made careful studies of the effects of practice upon the learner The first researches were in the field of telegraphy, later experiments studied the attainment of skill in typewriting The purpose was to discover the influence of repetition upon various types of learners in securing different grades of skills In learning most motor skills rather rapid progress may be made at first while some proficiency is being attained; but eventually the up-curve of progress flattens out into a plateau when but little progress is made In habit forming, the plateaus are of great importance When a child finds he is not making progress, that is, when a plateau shows no improvement despite all practice, he is apt to get discouraged The duty of the teacher is to encourage pupils, perhaps advise stopping practice for a while, suggest new ways of practicing, commend all honest efforts, or be more particular about breaking the skill up into easier parts The teacher should understand that all of us are too easily satisfied with a modicum of skill What we need is to work after the first novelty has passed, for if we persist we shall ultimately attain greater and greater proficiency If we go by easy stages we shall learn better Practice periods should not be too long. Some plateaus of no progress seem to be inherent in acquiring certain skills because the learner finds that he cannot go ahead until he learns the intermediate steps, but plateaus due to excessive fatigue, or to lack of interest, or to the prejudice or laziness of the learner can often be taken care of by a skillful teacher The number and the length of plateaus are due to the type of learning and to the capacity of the learner Plateaus

may represent either short or long periods of arrested progress Teachers should know that individual peculiarities set limits to the possible attainment of skills in individual cases

**Teaching and learning.** The essential task of the teacher is to occasion, to stimulate, and to direct pupil activity, so that learning and personal development may result It is the function of the teacher to shape the daily program and the class procedures in such a manner that the child responds in ways which contribute to his proper development If, for example, the pupil is to acquire skill in writing there must be much practice under the inspiration and guidance of clear and correct ideals and of patterns of response. John will never become a good penman if he and his teacher simply talk about writing Skill in writing comes only by giving attention to suitable, thoughtful, and adequate repetition of correct forms in correct movements If a pupil is to become a skillful oral reader, no progress will be made if the teacher restricts herself to silent reading techniques and devices only, and vice versa

To teach requires definite aim in terms of the changes which the teacher desires to bring about in the child Bagley and Keith,[1] in an *Introduction to Teaching*, state that "To stimulate, encourage, or direct learning is the soul and substance of the art of teaching It is the pupil himself who must learn, without activity on the pupil's part—without some dynamic expression of a will to learn—the efforts of the best teachers will be futile" These writers make it plain that learning has a direct bearing upon doing, for to learn is to acquire forms of behavior, new conduct controls

The teacher deals with the entire boy or girl, body, mind, and character, every thinking teacher understands and realizes this She takes note daily of bodily conditions and of health habits; she guides and directs the pupil in the development of ideas, ideals, and habits, and she gives constant attention to the shaping of human personality or character. These three

[1] BAGLEY, W C, AND KEITH, J A H—*An Introduction to Teaching*, The Macmillan Company.

phases of human life—physical, mental, and moral—are inextricably intermingled Health of body has much to do with success in school work and in all of life to follow, the possession of a sound normally functioning nervous mechanism furnishes the basis, at least, for the development of the child's character Moral development is also in a very large measure dependent upon mental development, upon the ability to remember exactly, to image conditions as they are, to form clear and correct ideas, and to solve problems by a course of thinking which arrives at a well-defined goal Teaching and learning have to do with every phase of a child's life and of his preparation for future living

## REVIEW, TEST, AND PROBLEM EXERCISES

1. What is the relation between knowing the rules of a game and learning to play the game skillfully?

2 Show that the formation of a conditioned reflex is a form of learning What connection exists between the conditioned reflex and the law of effect?

3 Illustrate the relation between habit formation and memorization.

4. When has anyone really learned to swim? When has anyone learned Kipling's "Recessional"?

5 Indicate several ways in which a teacher can assist pupils in learning how to do their work more effectively and economically.

6. In your opinion, is learning purely a mechanical process, or do you believe that learning involves innate desires, inner urges, and purposes?

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*Note* Every teacher should read "How to Acquire New Skills," by Professor James L Mursell, a condensation in the July, 1936 READERS DIGEST Dr Mursell's book is entitled "Streamline Your Mind," published by J B Lippincott Company in 1936.

## CHAPTER XVII

## MOTIVATION THROUGH PROBLEMS AND PROJECTS

**The inevitable reaction.** The growth and development of classroom procedure during the past generation is interesting and instructive to those who are in the midst of the problem and continually searching for better ways of teaching Formal methods, in which subject matter rather than the needs of the child was stressed, have been in vogue not alone in decades gone by, even in the present day there is much of this kind of teaching going on, particularly in rural schools During the past quarter century repeated efforts have been made to break up the lock step of formal testing technique by means of the socialized recitation, motivated activities of various sorts, and the use of problems in geography, history, and other subjects Later, the project plan and method were thought to be best calculated to secure the maximum of pupil self-activity and the greatest personal development of the child in independence, initiative, and judgment

At the present time the "activity program" or the "activity curriculum" is considered by adherents of the progressive school to be the best type of teaching-learning procedure This extreme form of school practice is derived from the project method and involves the use of both problems and projects The essential characteristic of the activity program is the large use made of centers of natural interest This subject is discussed in Chapter XX There is a constant tendency on the part of thinkers in the field of education to try out methods which will result in greater pupil response, more active personal participation, and more extended social co-operation It is inevitable that every thoughtful teacher will become dissatisfied with the formal hearing of lessons in which mere un-

thinking memory activity largely prevails. Such a teacher will see that vital teaching must meet the genuine needs of the child as shown in the formulation and solution of personal problems growing out of actual personal difficulties. If the school is to offer real life situations and to prepare children to solve the problems of life, surely some form of dynamic teaching and learning is necessary.

**Nature and attributes of the problem.** Life abounds in problems. We are continually confronted with situations which puzzle us more or less. We don't know what to do under a given set of circumstances, there is confusion, the conditions are difficult, we cannot see our way out. Such problems are of great variety. Some of them are small and relatively insignificant; others are large and far-reaching in their consequences. An aching tooth is a problem, but an aching heart is a larger one. Older people should not think that the problems of children are of no importance. To the child his personal problems are of great significance. The duty of older people is to teach children how to solve their problems.

Many of our decisions have been handed over to the "effortless custody of automatism," that is, to habit. We even have habitual ways of solving problems. However, our habitual ways of reacting do not solve all of our problems, so we are forced to think. It is of course true that some people do very little thinking because thinking is hard, even painful, most people seek the line of least resistance, the way of habitual response. The problem implies purposeful, intellectual activity in which the individual attempts to answer a more or less complicated question by canvassing the various alternatives and then making some choice. A problem presents a situation demanding choice. In the work of the school every subject comprises many problems if only the teacher and the pupils can find them and formulate them. Take so simple a matter as learning a word. The old orthodox method was mechanical repetition of the letters. We now actually *study* words, which means that we find problems in words. In the word *tangible,*

for example, there is probably one letter which is usually the problem Which one is it? What are the difficulties with the words *owing, perceive, recommend, vaseline, kerosene?* We study, teach, and really learn words because we find problems in words

**Problems and thinking.** Julius Boraas, in his suggestive and useful book, *Teaching to Think,*[1] in common with other writers, makes thinking a *form of behavior*, inner behavior which he contrasts with outer behavior Professor Boraas makes clear the great economy and advantage of this inner behavior as compared with outer trial-and-error behavior, which is wasteful of time and energy He says "Regarded from the standpoint of outward activity, thinking is an inward activity 'Stop and think' does not mean that all activity shall cease, but refers merely to outward work In this sense, recalling past experiences, imagining new things, solving a problem, systematizing a mass of details, constructing an argument, and judging of values are all classed as thinking" Kilpatrick, in his *Foundations of Method,*[2] states that "thinking is a meaning appropriately at work" It is important that children get many and exact meanings as the basis for thinking "Practical thinking is a foretelling of what to anticipate or expect when one faces a situation." "Thinking is to be considered an adventure into the unknown future"

**Problems imply thinking.** A problem suggests thinking and problems can be solved only through thought processes If a situation suggests an habitual mode of response, there is no problem and no need for thought Most of us do not need to put much thought upon the matter of truthtelling. When a situation arises which requires that we either tell the truth or falsify, our habitual way of responding truthfully will settle the matter quickly Thinking is demanded when a new situation presents itself which is different from preceding situations We commonly use the word *thinking* to comprise any and all mental

[1] BORAAS, JULIUS—*Teaching to Think,* The Macmillan Company 1922
[2] KILPATRICK, W. H —*Foundations of Method,* The Macmillan Company, 1925

activity. We say, "I didn't think," for example, which in this case may mean, "I didn't remember" Or we say, "I can't think how to start the car," when certain unusual, unexpected conditions exist In the latter case a course of imaging and reasoning is suggested, as well as use of memory When a situation causes us to think, it produces a reflective state of mind in which we weigh various items or data to fix upon some conclusion.

**Two types of thinking.** Sometimes our problem-solving thought is confined wholly to our minds, we might term this *subjective* thinking In solving problems in arithmetic and geography there is usually no more than this mental activity involved. But often our problem solving takes us actively into the field of things—the *objective* phase of the process For example, the soft water tap at the kitchen sink does not cause any flow of water, though wide open Here is a problem, which in this case is not so difficult when we consider that tank and pipes are in the attic, and that the temperature has been twenty degrees below zero Or in this particular instance, the solution may be faulty because the proper pipe is not heated When a piece of pipe about two feet long is given proper attention, the water soon begins to flow Faulty thinking failed to locate the source of the trouble More accurate thinking of the objective sort produced desired results

**Need for experience.** One of the important elements to consider in this question of problem solving is that of the need for experience to furnish the means for making solutions or for doing the thinking No one, child or adult, can solve problems or do any effective thinking without the raw material of ideas, images, or experiences of suitable kind and extent We interpret life in terms of what we already possess He who has had the widest experience in life and profited by it will have the largest fund for problem solving That is the reason why an intelligent, observing, active man or woman accumulates wisdom with age It takes time to learn to judge and to form conclusions which are well-founded and safe. One of the functions of the school is to give the child as many normal, useful, typical

experiences as possible This explains dramatization, excursions, school exhibits, construction work, projects, and other activities School life and life outside of school should mutually reinforce each other Children differ greatly in their experiences according to their social station in life and their opportunities for seeing, doing, participating, and learning through actual living In the better schools children are given opportunity to do many useful things, and actually to participate in a variety of co-operative, social activities The up-to-date teacher guides pupils in finding problems in their study and in all work of the school As the class exercise proceeds, if it is placed upon a thinking basis, the teacher will often stimulate pupils to suggest problems which may be formulated at the time and written on the board, or which may be left for formulation as a part of the study procedure Many rural teachers do not make use of many problems themselves because they have not been trained in the discovery and stating of problems. There are countless problems connected with the successful operation of a rural school, a thoughtful teacher is continually finding new problems in the daily situations

**Means of solution.** After a problem has been clearly and definitely stated, the next step is to find the means of solution If, for example, the work is in geography, the pupils should be directed in finding all the facts which the textbook contains, bearing upon the question for study Pupils need to be shown time after time how to use their books to get answers to questions This is a practical form of silent reading Then in addition to the basal text there are the dictionary, the encyclopedia, and the other reference books of the library Pupils require daily practice in using books for problem solving Many times, besides using books, people need to be consulted, maps made, diagrams drawn, in order to solve the problem. In all successful thinking the problem is kept clearly in mind Often it must be stated and restated so that it will not be forgotten or ignored Finally, when an answer has been secured, means should be taken to test the results or to check up to see if the conclusions

are correct Pupils thus form the checking-up habit, a valuable life habit for every one of us in order to avoid error and to arrive at safe and usable conclusions

**Advantages of the problem method.** 1 The use of problems necessarily *stimulates pupils to think*, and the processes of solution guide pupils in right habits of thinking While much of life is controlled by habit, it is true that the progress of the human race in every field of endeavor is due to thinking activities In a democracy it is of the utmost importance that each citizen, so far as possible, learn to think for himself

2 The problem method tends to *break up the formal routine* of the usual recitation procedure When pupils have concrete problems of personal interest, there is much more likelihood of having a free discussion, a conversational exercise, a general give-and-take, in which ideas and suggestions are weighed and valued for what they are worth

3. Through the use of stimulating and well-formulated problems the *necessary facts* which the child must learn will be *fixed in mind* by a rational process and not by dreary, unthinking, mechanical drill exercises Is the schoolroom, for example, adequately lighted? What must be known and what must be done to solve this problem? In the course of the solution, pupils will get valuable experience in computing areas of rectangular surfaces and are much more apt to remember the process because it is related to a definite, practical, interesting problem

4 *Lesson assignments* in the form of problems are always *more interesting* to pupils than page assignments Moreover, if problems are assigned, pupils have definite work for the study period There will be a real objective, a particular line of approach and attack will be set up for pupils' efforts Children of varying abilities, moreover, all find suitable work to do.

5 It goes without saying that a *problem arouses interest* Life never grows stale so long as it affords enough problems which are neither too hard for us to work out, nor so easy as to give no adequate stimulus. Moderately difficult, perplexing situations give zest to life and spur us on to effort So it is in school. A

teacher who uses problems in geography, history, and reading, as well as in arithmetic, never complains of lack of interest.

6 The rational, thoughtful solution of worth-while problems *develops initiative, self-reliance, and independence*, and prepares the pupil for participating, effective citizenship One of the legitimate charges against the public school has been that pupils are not adequately guided in developing these qualities of character Such deficiencies may often be traced to formal class procedures

7. Problems *motivate school work*, and motivation is greatly to be desired The usual testing recitation can never motivate school work as it should be motivated, because of its lack of reality and of personal appeal A rural teacher needs to motivate her work even more than a grade teacher, because of its assistance in solving the problem of discipline.

8 Problem solving *prepares for life*, surely that is what the schools are for Very much that is done in some schools not only does not prepare for successful living, but on the contrary actually weakens the child for meeting the affairs of life A teacher is on the right track when she connects her school work with concrete realities as much as possible.

9 The use of problems secures *purposeful activity* in place of mere formal book study and mechanical recitation work The best writers at the present time are stressing the need for aim or purpose in the work of the school, a little thought makes it clear that, other things being equal, those who set up definite goals toward which they steadfastly work are the ones most apt to succeed in all walks of life

10 *Problems add reality* to school life. We should look upon the school not simply as preparation for life, but as life itself. In the best elementary schools, like those connected with Teachers College, Columbia University, and the University of Chicago, for example, pupils engage in all sorts of real life activities, getting experiences in this way which are highly educative

**Guidance in thinking.** Probably no teacher can render her pupils a greater service than to teach them to think accurately and persistently when confronted by a problematic situation.

The following comments and suggestions are offered in the hope that teachers will find them useful in at least pointing the way to a better type of teaching:

1. Successful living demands a certain *critical habit of mind* such as leads the individual to challenge statements for the purpose of ascertaining their truth and validity. There is a gullible type of person who is easily hoodwinked and made to believe all sorts of things. The school should do all in its power to develop the habit of testing statements and of judging the value of evidence.

2. Every effort should be made to have pupils get *clear and definite meanings* of the words and terms in arithmetic, geography, physiology, and other subjects. Many pupils have trouble in thinking because they do not know the exact definition which lies at the basis of the solution; the dictionary may be a help or a hindrance, depending on how it is used. Most dictionary work would better be group study under the teacher's personal direction.

3. Pupils can be trained to ask *Why is this true?* or *Why is this not true?* in the process of clearing up a situation. For example, in the sentence, "There is a tide in the affairs of men," is the first word an adverb or not? John says it is an adverb. All right, let him prove it. He finally discovers that the word does not conform to the definition test, so it must have some other function. What is it?

4. Children need to be shown over and over again the vast difference between mere *personal opinions* and *real knowledge*. The ability and the habit of forming opinions only upon the basis of as much evidence as can be secured are of great value to any person. Pupils should sharply distinguish opinions from real knowledge. Opinions may be helpful and necessary, but, as Sam Jones used to say, we should take off our hats in the presence of a *fact*.

5. Teach pupils to *face the facts* and not side-step or run away from them. In matters of sanitation and hygiene, to illustrate, some otherwise intelligent people scoff at the antitoxin treat-

ment for diphtheria or the use of the Schick Test These are the same people who say there is no value in vaccination for smallpox Consult the facts in the case Then if you are a reasonable person, there is only one possible conclusion

6 Use every means at hand to *overcome prejudice and superstition* Unthinking people are often filled with all sorts of prejudices and entertain the most foolish superstitions How can a thinking person be so afraid of the number 13 that he will not sit down with twelve others at the table or take room 13 in a hotel under any circumstances? Many hotels have no room 13, for they know it will seldom be occupied Honest thinking will do away with such prejudices and superstitions

7 Guidance in thinking involves the *evaluation of statements* and their arrangement in order of importance If the teacher frequently says, "In this paragraph what do you think is the most important statement?" pupils get good practice in a phase of the thinking process Such a question in geography, history, and reading is a useful one Selecting topic sentences and names for paragraphs will further concentration, careful silent reading, and more accurate thinking

8 The habit of *suspending judgment* is one which makes for better thinking and the avoidance of many unnecessary troubles in life Pupils can be taught to wait for more evidence before deciding the question which is under consideration Many times the acquisition of more ideas places the matter in an entirely different light Jumping at conclusions is a risky and even a dangerous habit of mind. The school should develop the opposite habit

9. Thinking is *seeing relations*, which means making comparisons Everything in the world is related, the world's most famous thinkers, such as Galileo, Newton, Edison, or Kepler, were people who could see the most relations, particularly the more subtle but significant ones below the surface. The greatest living thinker is perhaps Einstein.

10 *Conclusions need to be tested,* one of the most valuable habits in life is that of checking up results to see whether they

tally with facts and reality. School people can find many lessons in this checking up in the great world of industry In every great industrial plant, banking institution, or mercantile establishment, the greatest pains are taken to check up on all products, materials, processes, and phases of the enterprise, in order to avoid waste and to promote efficiency In school work answers and results should be repeatedly checked to prove their correctness

11 Teachers should realize that *requiring exact statements* is one of the best ways to promote exact thinking Our modes of expression have decided influence upon our ways of thinking Teachers must not accept loose, inaccurate half-truths, they should hold pupils to clear, correct formulation of their thoughts, if they would guide them not only in English, but in thinking

12 It is useless simply to tell children to think, to concentrate, or to study the lesson *Pupils must be shown how to think,* to concentrate, or to study Thinking is often a complex process involving certain necessary steps, such as finding and stating the specific problem, accumulating the data or facts for solution, trying out various ways of doing, and finally deciding on what seems the correct way Sometimes thinking is the simple process of getting meanings and of understanding ordinary relations between ideas or meanings In silent reading procedures today various types of thinking processes are utilized for the pupil's benefit

13 In the problem-solving or thinking procedure *the state of mind* is of prime importance Real thinkers are cool, calm, poised, and patient They do not hurry and they do not worry They deliberately and confidently set up aims or goals and seek the evidence which will bear on the question in hand They avoid overconfidence as well as a doubtful, pessimistic attitude. They are seeking after truth; they welcome truth wherever it can be found

14 The careful thinker is willing *to try several ways* in order to find the best way If the class is working on the problem of a class or school paper, for example, and the particular question

up for decision is a suitable name for the paper, the thoughtful members of the class will be willing to take several days, if necessary, to solve the problem most satisfactorily Perhaps a score or more names will be gathered from various sources; finally one will be found which best meets the local requirements, in the opinion of the class

15 There are many opportunities in the work of the school to show *the practical value of thinking* In a rural school the farm situation offers an abundance of material Every successful farmer must think He is continually meeting new problems On the other hand many farmers fail in greater or less degree because they are groove-runners. They do things this year just as they did them the year before They are the victims of tradition, custom, prejudice; they lose out because of this mental attitude, because of unwillingness or inability to think Some teachers fail, at least relatively, for similar reasons

**The problem method in geography.**[1] It is generally accepted today that the problem method of teaching geography is by far the most satisfactory procedure from the standpoint of interest, motivation, and effective teaching and learning It can be used successfully by the average teacher in the rural school. The following excerpts from *A Teacher's Geography*, as well as the problems themselves, will give the student a point of view and an initial interest which should lead on to much further reading and study.

The problem method of presenting geography sets up a definite goal for the pupils to work toward The pupils are confronted with a definite challenge. Facts are secured and evaluated with reference to their bearings on the problem. The pupil no longer looks merely for interesting facts about a topic. He must constantly exercise judgment. The same facts that are mastered in a topical outline may enter into the study, but the facts are meaningfully related The details are of value because they are necessary in understanding the organizing center which is revealed in the stated problem A driving force or motive to

[1] For this entire section, including the problems, the author is indebted to The Macmillan Company and to Dr. M E Branom, whose book, *A Teacher's Geography*, emphasizing the problem method, is widely known and used

prompt the pupil to put forth effort is provided in the purpose to be realized

It should not be inferred that only minimum essentials should be taught But much freedom is left the teacher and pupils to deal with numerous worth-while supplementary details The pupil should have a much richer conception of geography than is involved in the minimal essentials, but these additional appreciations, skills, and knowledges may vary with groups and with individuals Social needs are cared for through minimal essentials, individual needs and interests are cared for through additional materials

In using the problem method, the teacher should not arbitrarily drag in irrelevant details. Any essentials included should be vital to the problem Otherwise the problem method is merely a disguised form of the topical outline or worse. Pupils should be trained to intellectual honesty If vital details cannot be mastered in relation to problem requirements, these details should be taught through supplementary topical discussions

A problem presents a challenge to the pupil to secure and interpret material that will result in its solution The pupil who has a definite goal, requiring the exercise of judgment to reach it, will probably be more interested in his work than the pupil who is asked to memorize various interesting facts

In some instances the pupils have sufficient interest in a problem to attack it without any attempt to interest them in it Under these conditions time is wasted in attempting to build up an interest that already exists Frequently a preliminary exercise that will arouse a sympathetic attitude toward the problem is needed Preferably the exercise should arouse the pupil's curiosity and should lead to a 'startling' or perhaps unexpected discovery A discovery that conditions now are different from those that formerly prevailed, or that conditions are different from those that might be anticipated because of certain facts, frequently arouses a deep-seated interest in the discovery

Students should become familiar with Dr Branom's very suggestive and helpful discussion of the use of the problem method in teaching geography

## Illustrative Problem Questions in Geography

The following problems from the Branom text either involve (*a*) explanation of physical phenomena, (*b*) inferences concerning the probable effects of physical phenomena, (*c*) discovery of effects leading to an attempt to find explanations of effects; or

(*d*) ability of man to dispose of the products of activity There are six problems of each of the four types

(1) Why is alluvial soil frequently very fertile? (2) Why is ocean water salty? (3) Why does the Mississippi River have a large delta? (4) Why is iron ore concentrated near the head of Lake Superior? (5) Why are there many caves and springs in the Ozark region? (6) Why is the coastline of Norway irregular? (7) How has the Nile River affected the people of Egypt? (8) How have ocean currents affected man's activities? (9) How has the Mississippi River influenced the development of St Louis? (10) How has the Isthmus of Panama affected oceanic transportation routes? (11) How have mountains affected the construction of railroads in the western part of the United States? (12) How has climate influenced the extension of wheat production in Canada? (13) Why has commerce on the Mississippi River declined? (14) Why is cotton the chief money crop of the Southern United States? (15) Why has Los Angeles become a larger city than San Francisco? (16) Why is southeast Asia very densely populated? (17) Why is Boston an important fishing center? (18) Why is the largest city of Mexico in the interior? (19) Why does Denmark secure a high price for its butter and eggs? (20) Why is California the leading state in the production of fruit? (21) Why has the center of the quinine industry shifted from Peru to Java? (22) Why cannot the United States compete with China and Japan in the production of silk and tea? (23) How can Washington apples compete with home-grown apples in the markets of the East? (24) How has Argentina been able to increase its exports of animal products?

**Definitions of projects.** Many writers have set forth their notions of the meaning of the term *project* It will help the young teacher to clarify her thinking if she will carefully study these definitions and explanations of projects:

A project is a problematic act carried to completion in its natural setting —Stevenson

The project is considered to be an act carried to completion in its natural setting, and involving the solution of a relatively complex problem —Charters

The term project contemplates a complete act (or experience) which the agent projects, purposes, and within limits, sees through to completion —Kilpatrick

A project is a whole-hearted, purposeful activity proceeding

in a social environment, or more briefly in the unit element of such activity, the hearty purposeful act —Kilpatrick

A *problem* is a life topic (unit of learner's experience) in which the processes and objects of learning are largely mental

A *project* is a life topic in which the processes and objects of learning are largely manual.

An *appreciation unit* is a life topic in which the processes and objects of learning are largely emotional

It should not, of course, be understood that there will be no manual elements in a problem or that there will be no thinking in a project, much less would it be safe to come to the conclusion that there will be no appreciation in problems and projects —Stone

I understand by project a complete unit of experience The essential aspects or elements of an experience are, in the simplest form, a situation and the response to it This, however, will not describe adequately what is meant by the type of experience called complete Such a unit includes the following phases: situation, problem, purpose, plan, criticism of the plan, execution, judgment of results, appreciation This is, of course, not a chronological order, strictly speaking, as a feeling of appreciation will spring up in anticipation of the outcome, while on the other hand, purpose persists and plan is modified to the very end Negatively, the project is not to be confused with mere problem, with motivation, with incidental learning, with correlation, with self-activity, or with the idea of general method as illustrated by the Herbartian formal steps To understand what the project method is we have only to go out into life and study any case of purposeful living Perhaps, then, the word purposeful should be added to the original definition of a project—a concrete unit of purposeful experience This will distinguish the project method from ordinary habitual reaction, as thinking, planning, criticizing, etc , are essential I may add that the results to flow from the project will include growth in initiative, in power to think, in judgment of values, and in appreciation, as well as in concentration and power of organization, at least

within the range of specific suggestions in which the experience functions.[1]—Hosic-Stevenson

Professor Stevenson comments (p. 85) on the statements by Hosic, as follows

This characterization provides for reasoning as against the memory of information, for in the unit of learning he includes situation, purpose, plan, criticism of the plan, execution of the plan, judgment of results, and appreciation. In carrying out this unit new situations would arise which would demand reasoning. Since the unit of experience provides for execution, it contemplates carrying the act to completion In another summary Hosic indicates that the project is an "organization of school life in accordance with life in the home and community"; hence a natural setting for the problem is provided.

Alice M Krackowizer says

Any purposeful activity determined upon and carried to a successful conclusion becomes a project

Projects of all kinds, involving play, social experience, nature experience, constructive activities, are part of the child's daily life, long before he enters school, they should continue as parts of his daily life under normal conditions while he is in school

All projects include the problem type in so far as they are not merely unconscious responses The process of carrying out projects includes thoughts, suggestions, and activities rejected as well as those finally selected as pertinent.[2]

All of the above definitions of projects and the project method are quoted by Stevenson in his book Stevenson concludes his Chapter III with these statements *"The provision for the natural setting of the teaching situation is the distinct contribution of the project method Without the natural setting there is no project"*

**The problem-project method.** Some writers use this combination term to cover all of the activities which have heretofore been designated by the two terms, *problem* and *project*, used separately The compound word seems best to express the

[1] STEVENSON, J. A —*The Project Method of Teaching,* The Macmillan Company 1925.

[2] KRACKOWIZER, ALICE M —*Projects in the Primary Grades,* J. B Lippincott Company, 1919

general notion of both intellectual activity and of manual or externalized forms of doing—the subjective and objective phases of the participating, co-operating procedure. In geography, problem solving as a rule involves simply the use of the various references, the textbook, magazines, the library, without much if any manual activity; whereas in agriculture we have in such a problem-project as the selection of seed corn a union of thinking with actual doing. Practically all projects involve one or more problems; in subjects like geography, history, and even English there is always an enterprise to be carried out. The making of a bibliography is a problem-project, although of a different type from that of the hot lunch in a rural school. The term *problem-project* emphasizes both the thinking and the doing and stresses the fact that the two are to be associated in accomplishing a set purpose. The term problem by itself can be reserved to designate work of the thinking variety in arithmetic, algebra, or mathematical physics, where there is no need to include the idea of the project for the simple reason that the manipulation of things is absent.

**Two interpretations.** The project idea and method of teaching may be thought of as either a broad, comprehensive philosophy of general method or simply a special means of presenting certain types of subject matter, mostly those having to do with the world of things. In the broad sense, some thinkers and writers would have us believe that the project is the central, pivotal concept of learning and teaching, which will completely revolutionize our school curricula and practice. There is no doubt that we need a scheme of teaching that will breathe into instruction a greater element of reality and genuineness. In other words, as Hosic puts it, we stand greatly in need of "dynamic teaching," which, he states, is "teaching that counts." There are those, and Hosic among them, who think that in the project method we have at last found a doctrine and a technique which embodies the essence of true Americanism. Hosic says: "The central doctrine that life at its best is active purpose, that people are at their best when they live so, that they learn best when they

learn so, is fundamental" Again, "Life itself is dynamic, therefore school life must be dynamic" The project method seems to give us more of real life, the dynamic element, than anything heretofore proposed—Then there are many other school men and women who see in the project method simply one way of teaching among many They do not expect the curriculum to be organized on a project basis, instead they state that teachers will use this type of teaching to present certain sorts of subject matter and will never use it as an exclusive method The writer of this book looks upon the project method as having so many limitations for the average rural teacher of today that its use should be restricted to definite fields of learning and teaching. At the present time the activity program, which includes both problems and projects, is the teaching-learning system most advocated by those school people who believe themselves most advanced in schoolroom practice

**Advantages of projects.** 1 The use of projects tends to eliminate the formal from the course of study, an outcome greatly to be desired In the very nature of the case, according to the above definitions of projects, it will be practically impossible to make purposeful activities, carried on in natural settings, formal or artificial

2. Projects carried out naturally and intelligently provide a far wider range of pupil activities than do other methods commonly in use In learning through projects the child is active mentally, morally, and physically Mentally, the whole mind is alert and in operation, just as when we find children engaged in their own play projects, self-initiated Not only is the child thinking, but he summons all of his experience to his aid in accomplishing his purpose He is self-directive, and there is a wholesome emotional tone often absent in performing set school duties.

3 Projects make much of extracurricular activities; such lines of work in a rural school as a school paper or a school society, for example, are often productive of very great pupil betterment and development

4 A wise use of projects not only makes better provision for individual differences, but it affords the opportunity for individuals to learn social, co-operative ways of working together very much more effectively than the usual recitation procedure

5 Project teaching brings the home and the school into closer and more effective relations through the need for co-operative efforts It is impossible to work out the hot-lunch project, for example, in a rural school as it should be done, without the school and the home finding more in common, and without harmonious relationships growing out of such a project, wisely conducted

**Limitations of projects.** 1. The use of project teaching often fails to make adequate provision for habituation exercises or drills which are necessary in the elementary school in order to secure important practical skills In arithmetic, for example, a large part of the work, say, in the first six grades consists of habituation exercises which should no doubt be motivated as much as possible by interesting types of procedure, but which the project in itself does not take care of adequately—at any rate as often conducted

2 It frequently happens that the items of knowledge are left without effort to arrange them into a definite system of logical arrangement The project activity needs to be followed by a different type of teaching which will organize the facts used or the experiences gained into some definite compact form for future use

3. It is a fact that not all children enter whole-heartedly into all the projects proposed Some are interested and some are not, because they have differing experiences and different desires The project method in itself is not always a guarantee of interest and motivated activity with all of the pupils of a given class

4 One of the serious limitations in a rural school is that the use of the project method may make for disorder Some teachers seem wholly unable to use either the project plan or the socialized recitation without losing a measure of control, probably because of personal weaknesses and defects Such persons will

do well to make cautious and limited use of the more extreme types of teaching procedures until the technique of management is mastered by them.

5 Hosic states that there is the constant risk that the teacher will try out projects which are not worth while because they are lacking in proper educational attributes. A large number of teachers will use projects merely as the fad or fashion of the hour, like extreme styles in dress

**Kinds of projects.** Projects have been classified in various ways by different writers Stevenson calls attention to the distinction between *manual projects* and *intellectual projects* Obviously a manual project involves a doing, a dealing with things in which the physical acts and outcomes are among the chief aims In a study of weeds, if the pupil sets about the task of finding several examples of each class of weeds and of learning how to identify them through making a collection, this would certainly be a manual project Collecting weed seeds and the making of posters might be a part of the procedure On the other hand, if teacher and class decide to make a classified list of the various references in the school on the subject of weeds, the work will be largely intellectual Project work involving the use of books only is mostly of the intellectual type.

Stevenson also classifies projects as *simple* and *complex.* It would be a simple project for a girl to set the dinner table, but it would be a complex project for the same girl to plan, prepare, and serve a four-course dinner for the faculty of a high school. It would be a simple project for the arithmetic class to compute the lighting ratio of a country schoolhouse, but it would be a more complex project if the class went to a neighboring farm to measure the silo and make a set of problems pertaining to it It is a relatively simple project for a student to prepare a news item for the city paper, giving an account of the Christmas program; but it would be a more difficult and complex project for a committee of five students to have full charge of the Christmas program for the pupils in the practice department These classes of projects overlap and are interdependent. Man-

ual projects involve intellectual activity, and complex projects are usually made up of several simple projects.

Four classes of projects have been suggested.

1. Certain projects require that ideas be embodied in some *external form*. When a boy makes a kite or a girl makes a doll we have this kind of project illustrated. In school, if the class makes a salt and flour relief map of the state, there is a social project of this first type.

2. In the second kind of project the *aesthetic element* predominates. It is an activity, social or individual, in which enjoyment and appreciation are the uppermost aims. In a rural district teacher and pupils might very well have a program in the school society some afternoon devoted entirely to music. There could be group singing and individual selections. A phonograph or the radio might be used as a part of the program. Papers could be prepared giving accounts of some of the great composers.

3. In the third type of project, according to Kilpatrick, the chief aim is *problem solving*. There is a difficulty to overcome, a complex situation or problem which needs to be resolved. There are problems to solve in arithmetic, algebra, geography, and in the reading lesson. Some problems are large and some are small. There is undoubtedly a place in school for legitimate puzzles. Sometimes a class becomes so mechanically minded that it needs something to stimulate it intellectually. For example, such problems as these might be used as one means of helping to wake up a dead class. (*a*) Two men desire to divide eight gallons of sweet cider equally between them. The cider is in a keg which holds just eight gallons. The only measures they have are a five-gallon keg and a three-gallon bucket, how can they make the division? (*b*) If I tell you how many dimes and how many nickels a boy has, how can you find the amount of his money? (*c*) If all your parents, grandparents, and great-grandparents were alive and you should sit down to dinner with them, how many seats would the company occupy? (*d*) Of the animals in a farmyard two-fifths are hens; the rest are pigs and

sheep If you are told how many eyes and wings all the animals have, how can you find the number of hens?

4 The fourth kind of project has to do with *skills, habits, knowledge* An upper-grade language class in a rural school was evidently in need of training in written composition The teacher decided that the difficulty was chiefly one of motivation So the class, consisting of four girls and four boys averaging about thirteen years of age, after much preliminary class discussion with the teacher, were given the task of issuing six numbers of a school paper, which was to consist of four pages, each 9 inches by 14 inches The class did all the work connected with the paper, and decided on the name, the form, and the character of the contents The paper was issued every two weeks Certain funds amounting to about $10 00 were available. An excellent hectograph was purchased for about $6 00 The class became enthusiastic The copy was carefully prepared and repeatedly corrected The pupils developed language skills during the months of December, January, and February of practical lifelong value to them, all by means of a social, habit-forming project See the author's *The Country Teacher at Work*, Chapter Four on "Publishing a School Paper"

**Arithmetical projects** It is not difficult to find many practical, worth-while projects in rural-school arithmetic, that is, activities involving problem solving which may be carried to completion in their natural setting A few suggestions for such project work are made here for the rural teacher's consideration Probably some of these are not exclusively or technically projects, in the strict sense of the term·

1 Make the measurements and, using the resulting figures and the cost data which you may find in the catalogue of a mail-order house, find out the expense of giving the walls and ceiling of your rural schoolhouse two coats of paint

2 Draw the schoolhouse and the school yard to scale; then compute the area of the yard in fractions of an acre Let individual pupils get results until there is practical agreement What percentage of the total area does the school building occupy?

3 The net proceeds of the school social were $20 00. The class may take catalogues of school-supply houses and make several lists of ways to spend the money for the benefit of the school

4. Teacher and class may procure several copies of the booklet entitled *Postal Information,* and then make out and solve a series of problems involving varying parcel-post rates, according to weight and distance

5 A series of practical problems based upon the heating and ventilating system can readily be made and solved, such as comparing the area of the fresh-air inlet with the foul-air outlet and finding the air capacity of the room in cubic feet Is the air space sufficient for the number of pupils? Each pupil should receive about 2500 cubic feet of fresh air per hour Some of the patented systems are said to change the air every ten minutes. Compute the volume of air changed in one hour

6 Find the total valuation of the school district and the amount of money the district must raise to run the school; then compute the rate and find out how much John Smith will pay if he is assessed at $35,000 Does the school get any money from state or county? How much does the local district raise?

7. Many problems can be made out in connection with the hot lunch For example, the class can compute the cost of the various dishes for one month If the school has no hot-lunch equipment let the class figure the cost of installing a good equipment.

8 The pupils can readily find the market prices for butter, hogs, hay, cheese, milk, eggs, coffee, beef, shoes, clothing, and other articles Making out a list and noting the changes from week to week is a good project Using the prices for data, all sorts of useful problems can then be stated. A committee may keep a corrected list posted on the bulletin board

9 Which would be the more profitable crop on a given piece of ground, corn or potatoes, alfalfa or oats? Figure all the possible costs of production and then take the average prices over a series of years Find out about the character of the soil

and what each crop takes out of the soil Also compute the average market price of each crop over a period of ten years

10 Make out a year's budget for the rural school, indicating all sources of income and all items of outlay

11 Make a diagram of the home farm showing the various fields and indicating what they were or are used for The number of acres and the values of crops may be shown Many problems can be formulated Have the class write out several.

12. Make a complete inventory of all school property under the teacher's direction, giving approximate values of all fixed and all movable equipment There are several rural school arithmetics on the market. See also farm and country life problems in many recent general arithmetic texts.

**Projects in agriculture and nature study.** 1. Collect weed seeds in vials and label the bottles. Use the collection as the means for teaching useful knowledge

2 Select seed corn under the direction of a farmer

3 Make a chart or poster showing the various kinds of dairy cows, getting the pictures from farm journals and elsewhere. Similar work may be done for hogs, poultry, horses, sheep, and beef cattle See Pickard's *Rural Education* [1]

4. Make various kinds of booklets on leaves, weeds, birds, and wild animals These booklets may contain outlines, pictures, colored diagrams, and short descriptions They should have neat, decorated covers and be tastefully bound together

5. Collect and arrange various kinds of bark, wood, rocks, and seeds Pupils will try to find material if they have a tangible objective to work towards

6 Learn to identify twenty-five weeds in September, using the game or contest idea Each pupil should bring all of the different kinds he finds from time to time.

7 Test the milk of a certain cow for a week or a month Each member of the class weighs the milk from one cow, night and morning, tests the milk with a Babcock tester, and computes the butter-fat content

[1] Pickard, A E—*Rural Education,* Webb Publishing Company.

8. Learn how to use the rag-doll or some other form of seed-corn tester. This is a good practical project in the spring and it may have its phase of practical usefulness.

9. Raise a calf, a pig, a sheep, or a flock of turkeys, computing costs and profits.

10. Prepare an exhibit for the county fair.

11. Make a good bibliography of references on corn, potatoes, weeds, grains, cattle, or on some other subject, using all the books and bulletins available. Send for bulletins.

12. Test several samples of soil with litmus paper, and make a soil survey of the district. Or get the co-operation of the county agent to make more scientific and accurate tests with special equipment.

13. Draw the parts of a typical insect and make a booklet on insects.

14. Make a special study of the fly, especially as a menace to health. Excellent material may be found in books and bulletins so that it will not be difficult for pupils to make attractive booklets.

15. Arrange excursions to study the silo (or other objects of interest and educational value in the district) including the kinds of silos, how they are filled, and the computation of their contents. Make a list of such possible excursions for the school year.

The above is merely a suggestive list. No person can do it all. Let each teacher select the kinds of work which are most feasible in her school and district. It is unquestionably true that successful teaching of agriculture demands the use of problem-project procedures. Teaching agriculture without studying real things is a waste of time and energy. Good books should also be used constantly in order to get the necessary and correct information.

**The hot lunch as a project.** The best way to conduct the hot lunch in a rural school is to make it a social, co-operative project for the immediate school community. All the preliminary steps connected with the starting of the hot lunch can also be made a school or a class project. In carrying out the details of the hot-

lunch procedure day after day, there is rich opportunity for training pupils in many of the most important qualities of good citizenship It is easily possible to divide the work so that practically every child in the school will have something to do, at least sometime during a given week In this connection the student is referred to the chapter in which the details of the hot-lunch procedure are discussed It should be noted that in the hot lunch we have a distinctly motivated enterprise There is purposeful activity and there is the natural setting Moreover, the work is carried to completion in the natural setting There will be little difficulty in correlating the hot-lunch work with arithmetic, hygiene, and geography, this should be done

**Student-teacher projects.** In every institution where teachers are prepared the students must necessarily be engaged from time to time in carrying out projects connected with the regular work of the school, there will also doubtless be many extracurricular projects The following list is necessarily brief

1. Getting ready for and then putting in several weeks of observation and practice in a rural school in fall and spring. This project includes a report upon the experience when the student returns Part of the project also consists in keeping in touch with the regular, or associate, teacher during the year, co-operating with her in several ways, and receiving aid from her from time to time

2 Planning, preparing, and carrying out a Halloween, Christmas, or Thanksgiving social and program to which guests are invited The project includes planning all the games and the program, arranging for the refreshments, paying the bills, and doing everything else which is necessary to carry the project to successful completion

3 Preparing and serving a dinner to rural school supervisors and superintendents from some section of the state, comprising several counties This is a large undertaking, requiring the active services of at least a dozen young women

4 Making seatwork material of different kinds to use in their own schools the year after graduation

5 Serving on various standing and special committees, thus insuring, through co-operative activity, the performing of many duties of direct help in promoting the welfare of the school

6 Planning for during the year and going on several excursions to study many institutions and places A committee makes out a schedule after consultation with the principal and takes care of the problem of transportation, expenses are paid jointly by school and students

7 Getting out several hundred educational bulletins each month to rural teachers, rural-school-board members, and others Envelopes are directed and bulletins are folded, placed in envelopes, and mailed It is a useful social project in which rural teachers, supervisors, and many others are benefited

8 Serving a cafeteria luncheon to rural teachers of the county who come to the school for professional conferences in fall and spring This involves looking after all financial arrangements, making sure there is no loss, and solving the problem of preparing and serving the food in co-operation with one of the teachers

9 Taking care of the bulletin case where hundreds of various bulletins on many subjects are systematically arranged, so that when one is needed quickly the special student will find it readily in his or her compartment This saves time and helps the student

10 Putting on special programs, such as a Hiawatha dramatization, with proper settings and costumes Sometimes it is a Christmas play such as Dickens's "Christmas Carol," or Tolstoy's "Where Love Is, God Is," or an operetta such as "Hansel and Gretel" or "The Pied Piper of Hamelin" Students prepare the stage effects and the costumes They also take the initiative in rehearsals and in making suggestions for improving the general appearance, or ensemble.

**Problem—project—interest—motivation.** These four terms are placed together here in order to suggest their mutual relationships and interdependence. The words are most significant in modern school practice, for they embody the aims and efforts of educational thinkers to place school work upon a more

rational basis of reality and genuineness It is unnecessary to discuss problems and projects further in this connection except to say that the project almost always involves the problem. Projects are made up of a series of related problems In considering both problems and projects it is evident that the point of view is that of the child rather than the subject matter. The best teachers always look upon subjects as means to ends It is this viewpoint which gives meaning and value to the four terms of this topic Interest is the oldest in method terminology We use problems and projects partly because they are inherently interesting, and partly because they bring about the highest type of personal development The problem-project is naturally an interesting and well-motivated procedure In actual school work these four principles overlap and mutually reinforce one another continually If the rural teacher will master them and make them the underlying principles of all her work, she will find that she is doing genuine dynamic teaching

**When is work motivated?** Wilson and Wilson say in their book, *The Motivation of School Work*,[1] "The child's work is motivated whenever he sees a real use in it—whenever it satisfies some need he feels, provides some value he wants, supplies some control he wishes to possess, secures some desired end, or helps him to attain any definite goal" School work is motivated when pupils work because they want to and not because the teacher asks them to do something It is no doubt true that not all of the work of the school can be thus motivated and that children must be trained to do disagreeable tasks which they would rather avoid One of the great functions of the school is to guide and direct boys and girls in doing the work that needs to be done, even though it is not always pleasant and agreeable Nevertheless, we need to realize that the best work of the world is really not done under compulsion, but rather from an inner impulse born of genuine interest, either immediate or remote We cannot think of such men as Guglielmo Marconi,

[1] WILSON, H B, AND WILSON, G M—*The Motivation of School Work*; Houghton Mifflin Company Revised edition, 1921

or Chief Justice Hughes, or President Hutchins, or Walter Damrosch as being driven to their tasks They work because they love to work and because they have great purposes to realize and goals to reach Life is tremendously interesting to such people because it is full of intensely attractive problems Their work has the highest type of motivation In school work every effort should be made to have pupils ask questions, to sense problems, to realize personal needs, to see reasons for doing things The work of the school should be based on the needs of children and appeal to and utilize their experiences, if it is to be well-motivated, interesting, and therefore successful.

**Common native interests.** The teacher should understand the natural, inherent urges and desires of children which prompt them to action These are powerful impelling forces in many instances and can be utilized in making school work and learning more interesting and effective Often the play instinct or the impulse to make things can be turned into profitable channels in connection with desirable school projects and learnings

1 *Overcoming difficulties* As has already been intimated, this appeal should often be made to children There is a natural, pugnacious instinct which prompts all of us not to be downed by hard circumstances It is right and proper that John should be encouraged to fight out his battles, to persevere in solving his problems Every good teacher makes use of this instinctive desire not to be beaten in accomplishing personal purposes

2 *Making collections* We all make collections of all sorts of things because we love to see and handle the objects of our desire Some enjoy collecting, handling, and reading books A book is to them something very desirable With others it may be furniture, clothing, money, jewelry, or anything which is desired and personally valued The list is a long one. In school work children like to make and to keep things which belong to them This instinctive desire lies at the basis of the making of booklets and collecting leaves and pictures It is a useful form of motivation which can often be utilized in school work Pupils should be encouraged to take pride in such work.

3 *Entertaining guests* The teacher plans a mothers' meeting and makes it a social, co-operative enterprise for all the school She is sure to get some hearty responses, for the children naturally wish to make a good showing Read the discussion of Mothers' Meetings in another chapter, and consider how you can make this a well-motivated afternoon, from the regular class work to the serving of the refreshments One can think of other illustrations of this point without much difficulty

4 *Accumulation of property* Children usually work better if they get paid for it, but of course this is a motive which must not be overworked Children cannot always be hired to do their work or to be good Teachers cannot pay children to get them to behave Prizes and artificial rewards are a dangerous sort of motivating agency. However, if Mary has the prospect of earning $5 00 for her essay on "The Sanitation of a Country Home" which is to be published in the local paper, such an incentive seems a very proper one If all the pupils can earn money through a school social or otherwise to buy a picture for the school, there is a high type of social motive which is altogether wholesome

5 *Working for honors* Sometimes such work is a declamatory contest, or a debate with another rural school, or a spelling match in the school or between schools, or again it is an effort to have the school get the large banner for the year, indicating that this rural school is the best in the county in penmanship, arithmetic, spelling, or in other ways Such efforts and such motivation are indeed commendable In this work there is the stimulation of group interest and the pride which prompts all to work hard for the good name of the school. Whenever activities can be socialized, the benefits and the motivation are always more certain and perhaps more justifiable

6 *The urge to build* Children like to make things of wood, paper, or other material The desire to build or construct is seen early in life before the child goes to school. In an up-to-date rural school a large variety of materials are now furnished for construction work, particularly for educative seat activities.

Almost all children are happy and interested in this project work So we have salt-and-flour maps, sewing, making bird-houses, weaving baskets, and making paper-pulp maps There is no end to this type of work If a pupil, a class, or the whole school can make something for the school, such as window ventilators, a magazine rack, or a shelf for the cyclopedias, the making is an excellent socially motivated activity.

7. *Motivation of games* It is now quite common to make use of the play instinct in learning activities; we now have games in spelling, language, reading, arithmetic, and other subjects. Teachers will experience no difficulty in providing games for motivated work from the various supply houses A thoroughly competent teacher employs the dramatic instinct to teach the powers and duties of the school officials and qualified voters at the annual school meeting Let us suppose that there are fifteen persons present at this important gathering, including three school board members The director or some other voter presides, the clerk reads the minutes of the last meeting and keeps minutes of present one The treasurer gives his report. The auditing committee reports A new board member is elected. District business is discussed Planning the annual school meeting thus becomes a well-motivated learning situation, in contrast to the dreary reproduction of dry-as-dust textbook materials

## REVIEW, TEST, AND PROBLEM EXERCISES

1. Compare learning by the project method with learning according to the activity program.

2 Make a list of twenty practicable and useful projects in teaching agriculture in a rural school.

3 Indicate several problems involved in printing a school paper and tell how you will meet them

4. What projects can you carry on in teaching geography in a rural school?

5 Enumerate several personal problems which you will need to solve during your first month of teaching a rural school Tell what you will do to solve these problems

6. What problems are involved in the work of teaching handwriting? How can you solve them?

7. Make a list of twenty educational activities in number work in the first three grades Here are illustrations Keeping score in bean bag or other games Looking up dates on the calendar and counting the number of days or weeks to the dates of birthdays or holidays.

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# CHAPTER XVIII

## PROVIDING FOR INDIVIDUAL DIFFERENCES

The writer vividly recalls a rural teacher many years ago who called the A-B-C pupils, one by one, to his desk on the elevated rostrum or platform where he taught them letters and words from the old *Sander's Pictorial Primer*. This was individualized instruction of a sort, though very crude and ineffective. The teacher was a tall, muscular, fine gentleman, a graduate of the state university. He knew nothing about the techniques of teaching, although his mentality was much above the average. He had a strong personality which was a decidedly wholesome influence. Most of his teaching was in the form of class or group instruction.

In an early day, say prior to the Civil War, instruction was largely individual. Gradually class or group instruction came to be the regular practice and is today exceedingly common. It is only within this generation that serious efforts have been made to individualize instruction. Mass instruction as found in our system of grades has become almost universal. Group teaching and the graded system have certain distinct advantages as well as many limitations. Pupils vary in ability; there are the slow, the medium, the bright. The graded class system provides for the average pupil and for progress through the grades at an average rate. But, what of the dull group and what of those whose abilities are above average? Slow pupils are often neglected and drop by the wayside, brighter children are held back by the "lock step" of the school machine.

**Individuals differ in every particular.** Our entire system of grades and of teaching pupils in classes is based upon the assumption that children are much alike in their learning capacities and ability to respond to classroom instruction. We have

gradually come to see that while children are similar in many particulars, some of the most striking characteristics of boys and girls, as well as of older persons, are to be found in their differences So far as certain general instinctive tendencies, common to the race, are concerned, children are to some degree alike For example, the social or gregarious instinct is found in all children, yet we know very well that some are much more socially inclined than others All normal children enjoy physical activity and like to play Moreover, certain types of play are common Practically all normal little girls like to play with dolls, and boys are quite apt to play horse or to impersonate the soldier The desire for possession is common and instinctive, but differs in rather a marked degree among children, the fighting instinct, though general and inherent, is also a notably varying urge

In school work teachers find that pupils differ much in native capacity and in achievement While perhaps the members of a given class may be grouped as bright, medium, and dull, we yet know very well that no two pupils are exactly alike in any one of the three groups An important principle for the teacher is that instruction should be adapted to the individual Our modern intelligence, diagnostic, inventory, aptitude, and other tests enable us to judge of individual differences more accurately than formerly. One of the greatest contributions of modern psychologic study is the test, which gives us the means of discovering the manifold ways in which pupils differ There are evident differences, mentally, morally, and physically Children vary markedly in honesty, sympathy, power of endurance, capacity for acquiring different skills, power to work with speed, ability to grasp meanings, power of imagery, types of memory, and the like A teacher can hardly make a more profitable study than to investigate the problem of individual differences

**Differences in bodily constitution.** We see evidences on every hand of the striking differences in people in physical make-up We have tall and short people, thin and fleshy folks, hair and eyes of many shades and colors Some people have large heads

and small feet, and vice versa We see heads of all varieties of sizes, shapes, and contours, some with high and some with low foreheads We know that the brain varies in weight and in nerve structure We know, also, that, in a general way, the size and character of the brain determines mental capacity The way in which the nervous system varies has much to do with learning and with the determination of personality Essential nerve structure and nerve protoplasmic composition and the character of the nerve cells and fibers have an important bearing on individual differences These physiological variations are due in large measure to biologic heredity and to social heredity, although environmental influences, such, for example, as the character and the quantity of food, are also of determining significance

**Mental and moral differences.** Whether due to hereditary or environmental causes, it is plain that persons differ as markedly in personality traits as they do in physical qualities It is of course true that the normal or abnormal conditioning and functioning of the body is a constituent part of the personality complex. Mentally, people range all the way from imbeciles to geniuses In every school we find bright and dull children and good and bad children, with the vast majority distributed between the extremes Temperamental types seem to be due partly to heredity and partly to the social and physical environment We know now that the endocrine-gland system is a large factor in the determination of personality The type of glandular structure, like the fundamental nature of the cerebrospinal nervous mechanism, is mostly a matter of heredity, but sometimes by the use of a variety of glandular extracts, the entire physiological, mental, and even moral aspect of the situation may be changed and improved for a given individual In what we call character attributes the average person is neither wholly honest nor dishonest, loyal nor disloyal, industrious nor lazy, responsible nor irresponsible, provident nor shiftless We find extremes in moral qualities, as in mental or physical, but we also find that most human beings are just average persons, neither

very bright nor very dull, neither conspicuous saints nor vile sinners

**Discovering and measuring individual differences.** It is now possible to discover how children and adults differ in various particulars Today measures of intelligence and achievement are common and are found in great variety There are measuring instruments which will give a fair picture of the individual physically, mentally, and morally, although tests of personality have not been developed to as high a degree of reliability as the others In many school systems the complete status of the individual is now charted by the use of scoring devices and graphs. There are record forms now which have spaces for all the essential data relating to health, to intelligence, to school progress, and to character or personality attributes In the larger systems these records are carefully and repeatedly checked and kept up to date We now have batteries of achievement tests for the different grades which have a high degree of reliability There are diagnostic, prognostic, and aptitude tests as well as tests for classification and guidance The teacher or student should write to the World Book Company, Yonkers-on-Hudson, New York, or Chicago, for literature pertaining to tests Various other companies also publish tests (See list at end of this chapter )

**Differences in learning ability.** Teachers have always recognized the fact that children differ in their ability to learn, but it is only within the last generation or less that variability in learning capacities has been subjected to scientific analysis and measurement Starch says that "if we measure a group of pupils in a given grade or class, we find that on the average the best pupil is able to do from two to twenty-five times as much as the poorest pupil, or is able to do the same task from two to twenty-five times as well as the poorest pupil" It is not unusual to find that in a given class of thirty sixth-grade pupils, where the average *chronological* age is about twelve and one-half years, the mental ages may easily, and often do, range approximately from eight to fifteen Learning abilities vary largely because of the anatomical and physiological variations in the structure and functioning

of the nervous system. One's learning ability is determined for him at birth, or more accurately, before birth. He inherits a certain type of nervous system which will throughout his life determine his general intelligence. It should be stated with emphasis, however, that learning in special fields can be decidedly improved by training, guidance, and skillful teaching. It is thought that the intelligence quotient (I. Q.) is not altogether a fixed determinable quantity in every case, but that it is modified more or less by environmental influences. Nature and nurture work together in most cases to cause fluctuations in the I. Q., but probably native or inborn capacity is the more important factor. Some children are "born short" and others are "born long"; it is impossible to ignore or minimize such differences which environmental influences cannot entirely remove.

**All learning is individual.** In a discussion of individual differences and differentiated instruction it is well to keep in mind that each individual does his own learning in any case. A class exercise may seem to be successful, but the teacher cannot be sure as to its success for individuals unless she gives tests. Such tests are often most revealing, showing that some pupils have learned everything, some nothing, and others only a part. It is only the reaction of the individual in his own particular way to his own particular learning situation that determines the nature and the extent of his learning. As a matter of fact, all instruction and all learning must, in the nature of the case, be individualized. This does not mean that there cannot be group teaching; it is quite possible so to teach the group that each individual member of the group is taught at the same time. This requires skillful use of teaching techniques by a well-trained teacher.

**Success and failure.** No matter how one looks at it, failures should be reduced to the minimum through more careful attention to the needs of individuals. Dread of not passing, failure to be promoted—these cause emotional disturbances in the life of the school child which may easily spell the difference between a normally developed individual and one with a twisted personality, dominated by worries, fears, phobias, and various

other perplexing emotions Too often school administrators, supervisors, and teachers have failed to give adequate attention to the inner life of the child where are found those hidden springs of conduct which have so much to do with success and happiness Failure is a serious matter; every child is entitled to feel that he is succeeding in some way. The child's school program should be so arranged that, no matter what his mental status may be, he can know the joys of success on some level of actual attainment Here is a field for individual diagnosis and for remedial treatment and here is a problem for every teacher to take to heart

**Influence of hygiene—good and bad.** Heredity is an inescapable and very influential factor in determining the nature and career of every one of us. Nevertheless, parents and teachers should have profound respect for the powerful influence of both physical and mental hygiene No doubt heredity sets limits to our possible attainments, physically and mentally; but there is a wide range for either the beneficent effects of good or the harmful effects of bad mental and physical habits Good food in adequate amounts, exercise, rest, sleep, freedom from undue anxiety and care, development of stable and wholesome emotional and other mental attitudes and habits, good working habits—all these will do much to raise the level of individual capacity and efficiency Habits which make for health of body and wholesomeness of personality will go far in neutralizing the evil effects of untoward or unfortunate heredity. On the other hand, it is common to see favorable and fortunate hereditary conditions relatively nullified by an evil social and physical environment and by lack of proper educational advantages It is quite possible, through varying educational procedures, to bring about a development of the majority of children that will result in reasonable social efficiency and in a good average of individual welfare, success, and happiness. Much depends upon the character of the schools, the teachers, the homes, the churches and Sunday schools, and the social environment provided by all other molding influences Good hygiene—physical,

mental, and moral—is of the utmost importance After all is said and done, we are gradually learning that the adaptation of educational processes to individual needs is one of the greatest present problems of the educator

**Plans for individualizing instruction.** The movement to adapt instruction to individual needs began over forty years ago. Starting with the Pueblo Plan in 1894 we have heard from time to time of the Batavia system, Dr Burk's experiment in California, the Winnetaka Plan, and the Dalton Plan "In the early days in both Europe and America instruction was largely individual, particularly in the lower grades Our present system of grades and of class instruction is relatively new in the history of education Though thinking men and women have all along seen that while there are certain great advantages in the simultaneous instruction of *groups* of pupils, it is also true that individual treatment because of individual differences is a vital necessity if the child is to develop for the best "[1]

The rural school offers many favorable conditions and opportunities for individualized instruction if the teacher understands the principles and procedures which need to be utilized In this section five well-known movements will be very briefly considered in the chronological order of their promulgation and development The rural teacher will find in each system or plan certain basic ideas which she can adapt to her own work Beside the five nationally known plans four other well-recognized expedients for individualization will also receive limited attention

1 *The Pueblo Plan,* so called because it was first used in the schools of Pueblo, Colorado, originated in 1894 and was the work of Preston W Search who gives an account of his scheme of individualized instruction in his book *The Ideal School* Superintendent Search arranged with his teachers to have all study done at the school Study instead of recitation was stressed Recitations became conference periods Individuals rather than classes, as such, were given first consideration There was no

[1] LOWTH, F. J —*The Country Teacher at Work,* The Macmillan Company 1930.

attempt to keep groups together, but the slow, the medium, the fast, all progressed at their own rate The central idea was correct, but the educational world was not ready for this so-called Utopian plan, moreover, Superintendent Search did not carefully work out a complete teaching-learning system as has been done by Superintendent Washburne of Winnetka, for example Undoubtedly the Pueblo Plan had a wide and a beneficial influence

2 *Batavia System* In 1898 Superintendent John Kennedy of Batavia, New York, began to use a plan of combining class and individual instruction, which had a rather extensive vogue and became known as the Batavia System The teacher will find a good description of this plan in W C Bagley's *Classroom Management*[1] In the Batavia schools the rooms were very large, so two good teachers were placed in charge of each room of pupils One teacher taught the classes and the other teacher worked with individuals at their seats Bagley says that "The application of the system to one-teacher rooms is made possible by what may be termed a doubly-alternating program For example, if the regular program provides for five recitation periods each week in geography, each alternate recitation period is given over to the individual instruction of the weaker members of the class" Thus recitation and individual instruction alternate with no two individual periods in immediate succession

3 *The California Experiment* In 1913 Dr Frederick Burk, president of the San Francisco State Teachers College, inaugurated a new form of instruction for use in his training or practice department, comprising all elementary grades The usual class system had not been wholly successful or satisfactory. So a plan was introduced whereby each pupil worked on his own lessons at his own rate of speed The common group or class assignments, as well as recitations, were abolished President Burk stated that "The result was electrifying Even the poorest pupils, practically, maintained the former class rate at least. The large majority went much faster, covering, two, three, four,

[1] The Macmillan Company 1924

and five times the amount of work by the class rate" This system is still used in this Teachers College Read an account of the plan in the *Twenty-Fourth Year Book* of the National Society for the Study of Education.

4 *Winnetka Plan* Superintendent C W Washburne of Winnetka, Illinois, is probably the most prominent present-day advocate of individual instruction, the Winnetka Plan, begun in 1920, whether wholly sound or not, has become nationally and internationally famous through the inventive and promotional ability of Superintendent Washburne, who was a former student of Dr Burk's Superintendent Washburne has presented his plan to audiences throughout the United States, has written a large number of magazine articles, has prepared textbooks based on his ideas, and has directed the preparation of Part II of the *Twenty-Fourth Yearbook of the National Society for the Study of Education*, entitled, "Adapting the Schools to Individual Differences" The Winnetka Plan does away with the standard recitation procedure, and in place of this a course of minimum essentials is offered to each pupil who proceeds to master these essentials at his own rate of speed The function of the teacher is to direct the activities of the child, to check up on his progress, and to see that each pupil is permitted and, moreover, encouraged to work up to his individual capacity The forenoon is devoted to individual tasks and the afternoon is given over to various forms of socialized activities and procedures The student will find the chief advantages and limitations of this system stated in *The Country Teacher at Work*

5 *Dalton Plan* This plan was first used by Miss Helen Parkhurst in Dalton, Massachusetts, in 1920 It has been introduced into various parts of this country and is used extensively in England The subject matter in this system is organized into *jobs* of work which the pupils are under *contract* to attack and complete according to individual ability and at varying rates of progress Dr Bagley states that Miss Parkhurst was likewise "strongly influenced by the teachings of Dr Burk and also by the work of Dr Maria Montesorri (an Italian anthropologist

who invented several devices for teaching young children, and who projected a general theory of education which had a wide-spread but temporary vogue)" "Each pupil works at his own rate, conferring with the teacher whenever necessary and passing to each succeeding *job* after its predecessor has been approved" Dr. Bagley says that "the essential feature of the present-day proposals for individual instruction (especially of the Dalton and Winnetka Plans) is the very careful preparation of printed assignments or sets of directions by means of which the individual pupil can master the materials at his own pace The teacher's time is then free for the giving of such individual help as may be needed" "Advocates of these and other systems of self-instruction believe that, by granting the learner a certain measure of freedom as to the learning tasks that he will undertake on any given day, a valuable training in self-dependence and self-guidance is afforded"[1] Students will find a good short description of the Dalton Plan in Ruediger's *Teaching Procedures*, published by Houghton Mifflin Company

6 *Grouping by abilities* Since we are now able to determine and measure individual differences much more accurately than twenty years ago, it is possible to classify pupils according to their abilities more readily than formerly Some have felt that by placing the slow, the medium, and the brighter children, respectively, in groups by themselves that the schools would be able to deal more justly by individuals When this plan of homogeneous grouping has been thoroughly tested, as in the Detroit schools, where it has been used since 1920, the evidence seems to indicate that the plan is a success "Sectioning on a basis of ability increases both the efficiency and the pleasure of teaching and is a valuable addition to our grading system because it makes possible a closer adjustment of group work to children's needs."[2] In the effort properly to classify a child

[1] These quotations from Dr Bagley are taken from *An Introduction to Teaching* by Bagley and Keith and from *Standard Practices in Teaching* by Bagley and Macdonald, both published by The Macmillan Company.

[2] *The Twenty-Fourth Yearbook*—National Society for the Study of Education, Part II

various means are employed, such as intelligence tests, achievement tests, judgments of both teacher and parent, carefully kept school records, and, when necessary, the advice of a physician In this connection the student may read Chapter IX in *The Country Teacher at Work* School records should give a much more accurate and complete description of a child and history of his school progress than is ordinarily found The principle underlying the plan of ability, or homogeneous, grouping is one which the rural teacher should understand and apply, for it involves the fundamental notion of providing for individual differences, and that is a universally accepted principle today

7 *Differentiating assignments* It is easily possible in a rural school to provide for different learning capacities by two- and three-level assignments of work to be done The author discusses this problem and gives illustrations in his *The Country Teacher at Work* Instead of piecemeal daily assignments of subject matter the teacher can easily provide a block of material which may be in the nature of a *contract* for a week, two weeks, or a month By carefully prepared written directions and questions the teacher will be able to care for both the bright and the less bright Some of the questions call merely for textbook facts and some are problem questions which demand thinking These questions can all be arranged in a ladder of difficulty The more capable pupils will be able to answer all of the questions, to do the entire contract; those of lesser ability will do less work, but will receive full credit for what they do Two-level assignments in such subjects as upper-grade geography, history, physiology, civics, nature study, and agriculture are usually sufficient; the superior children should always be provided not only with more work but with an enrichment of content It is understood, of course, that assignments comprise many forms such as projects, activities, pageants, dramatizations, experiments, demonstrations, and so on in all degrees of wealth of experience

8 *Directing individual study* A rural teacher has continuous opportunity to take care of the needs of individuals, both while they are working at their seats and also during group discus-

sions and conferences The student will find this subject discussed in Chapters XIX, XXI, and XXII. It is enough to say here that when the rural teacher has once grasped the idea of the need for individual instruction and of the relation between study and recitation, she will find that she is solving her teaching-learning problems with increasing ease, pleasure, and effectiveness Every rural teacher should stress study and not reciting, her constant effort should be to provide conditions for both the individualizing and the socializing of her instruction. Pupils must learn how to work effectively, and they must engage in a great variety of socializing activities also.

9. *Adapting recitations to individuals* If the teacher will form the habit of looking upon class meetings as opportunities for the discussion of individual and general problems and difficulties instead of a time for dreary profitless testing procedures, she will soon get into the way of using class time for helping children to learn After all, it is her chief task and her inestimable privilege to help boys and girls to learn, *i e*, to acquire knowledge, ideas, ideals, skills, habits, attitudes, in brief, to enlarge their personalities In recitation conferences and discussions the teacher can teach the class so as also to teach the individual, and she can teach the individual so as also to teach the entire group.

**Individualizing instruction in the rural schools.** Due to conditions in a rural school where the teacher has full control of the situation, there are many opportunities for taking care of individual differences Unless she is under a rigid system of supervision, the teacher can change the character of both her directed study activities and her recitation procedures She need not find her freedom restricted by a cast-iron program of formal recitations Instead, she can modify her teaching-learning exercises to suit the varying needs of her pupils from hour to hour and day to day

A skillful teacher can teach a class so as also to teach the individual and she can teach an individual so as also to teach the class In a rural school there is unusual opportunity to do both individual teaching between classes and socialized group teaching during the periods

of class work . . All may study the same picture, story, or poem, though no two are on the same level of understanding or appreciation. In a given list of ten words to be studied by ten pupils a pretest may disclose the fact that initial mastery of the words may vary all the way from zero to one hundred per cent accuracy Here then is presented a chance to adapt instruction to the needs of the child, and to offer such individualized drill as may be needed . . . In a rural school the intelligent teacher is offered the best possible opportunity to see to it that class and individual instruction constantly reinforce each other in interesting and effective ways [1]

In the following pages a number of suggestions are made as to what a rural teacher may do to individualize her instruction Some of the advice given here is in the nature of a summarized review of the more important particulars of this chapter, and other items have to do with certain practical considerations of a more specific character for the guidance of the rural teacher.

1. *Preventing failures.* A most significant objective of individualized instruction is the prevention of failures This aim can be realized if the rural teacher really knows her pupils and provides experiences and activities which are possible for all grades of mentality Failure is often due to the fact that the individual gets lost in the crowd He goes on day after day trying to do work which is beyond his capacity He stumbles through materials which he does not understand, his teacher fails to diagnose his troubles or to offer needed help A large percentage of failure can be prevented by giving adequate attention to individuals *in time*

2 *Modern texts* In making individualized instruction a success, the rural teacher needs the best textbooks published. There are now books on the market which are prepared especially from the standpoint of individual learning; the teacher should know about them More than ever before textbooks today are carefully graded and written in a simple, understandable style Every rural teacher should know the resources of her various texts as well as their peculiar difficulties Good books help greatly in solving the problems of individualized instruction

[1] Quotations from *The Country Teacher at Work*, The Macmillan Company.

3 *Contracts, or jobs* It is easily possible for an intelligent rural teacher to assign work in large blocks or contracts Daily fragmentary installments of subject matter which is not correlated or unified into related wholes gives the child an unorganized and distorted view of the entire unit A rural teacher should take pains to give the pupil a bird's-eye view of the entire unit of subject matter It is not difficult in such subjects as geography, history, physiology, civics, and agriculture to assign work in large units of related "jobs" to be done It is not necessary to use the contract idea *in toto*, but the central idea is very useful Previews, in this connection, are most important There should be a preview at the beginning and a general summary at the close of every piece of work

4 *Diagnostic and remedial procedures* At the present time, with our modern measures, there is no excuse for the teacher's not getting some fairly accurate idea of what the child knows and what he can do. It is possible to purchase diagnostic, inventory, and achievement tests which will give any teacher a good idea of where any child stands in his school progress In order to do successful remedial work, which is in the nature of individualized instruction, the teacher must necessarily have exact knowledge of the child's weaknesses and deficiencies. Some of the inventory tests can readily be made by the teacher herself and should be when possible Diagnostic and remedial procedures are daily affairs in a well-conducted modern school.

5. *Individual projects* The rural teacher should have a record book in which she keeps a large assortment of supplementary individual assignments of projects and activities There are many recent books which give explicit directions for such procedures. There are always some brighter pupils who can do more and better work than others Here is a chance for the teacher to provide profitable work for these better children If the teacher will use other textbooks, or such young people's encyclopedias as *The World Book Encyclopedia*, *Compton's Pictured Encyclopedia*, or the *Britannica Junior*, she will be able to

provide additional educational experiences of a profitable character Against the time of need the rural teacher should have on hand a plentiful supply of a great variety of assignments in every possible subject.

6 *Varied assignments* It should be the teacher's constant aim to adapt assignments to individuals Too often it happens that a rural teacher's assignments are of the most general, shotgun variety Instead, assignments should be as varied and as specific as the needs of individuals require After a good start has been made in this enterprise, the teacher will be surprised how easy it is to multiply assignments of a truly educational character Very often individual assignments grow out of individual difficulties and needs as they appear from hour to hour and day to day

7. *Study-guide sheets* Publishers have been alert in this field of individualized instruction and have provided some materials of excellent quality Workbooks carry detailed directions, questions, check tests, and graphs of progress They give the child very clear and specific suggestions on how to study particular lessons and how to test for mastery Teachers should make use of this commercial material, but they should also make out their own study-guide sheets, using the hectograph or special pencil carbon paper for making enough copies. If a teacher is particular to give her pupils complete and concrete helps to guide them in their study it will relieve her of a great deal of unnecessary supervision

8. *Reference materials* Individualized instruction cannot be carried on with much success unless there is plenty of reference material There should be an adequate supply of dictionaries, encyclopedias, and special reference books so that teacher and children will be able to find whatever information may be needed All reference material should be carefully classified and so placed as to be easy of access On many topics in geography, history, agriculture and other subjects lists of references should be posted for the use of the classes Older pupils can be taught how to prepare such lists.

9 *A flexible system* In classification, marking, and promotions no rigid system of requirements should ever be used in a rural school Pupils should be in classes where they can do the best work; in the rural school a child may be able to do sixth-grade reading but only third- or fourth-grade arithmetic Classification, marking, and promotion should all relate to the welfare of each child A child should be promoted whenever he is ready to do more advanced work, regardless of the calendar The teacher should never permit a marking or grading system to come between her and any pupil Pupils are worth more than marks or grades A pupil's classification should be determined on the basis of many factors, not merely on that of examinations or tests Intelligence tests must be used with caution

10 *Supply of problem questions* From whatever source derived, a rural teacher needs a good stock of problem questions, particularly in upper-grade subjects These are questions which call for thinking, if they can be graded and classified according to type and difficulty all the better If a teacher has a reservoir of first-class problems she will find that it will give her a new sense of freedom Of course she needs a supply of teaching-learning materials of all sorts which she can put her hands on without delay

11. *Utilize the entire library.* In order to have all of the books readily available for immediate and instant use, the library must be well catalogued, a good card index is indispensable. Many rural school libraries are but little used because the teacher does not know her resources, for one thing, for another, there is no convenient catalogue which she can use whenever needed In order to individualize instruction pupils must use many books So a rural teacher should early go through her books to find out what she has It may be that she can get some assistance in classifying, cataloguing, and arranging her books. Many bibliographies will certainly be needed

12. *Self-scoring materials* It is now possible to get study materials, such as workbooks and practice manuals, which are accompanied by self-checking or scoring devices It will pay any

rural teacher to find out about such materials In a rural school individualized instruction will become increasingly successful as pupils learn more and more how to direct their own work, how to test it for correction and mastery, and in general how to work independently This certainly does not mean that the teacher will not supervise all work carefully and also use her own tests

13 *Mental hygiene* It happens not infrequently that pupils fail to make satisfactory progress because of some mental, as well as physical, difficulty The mature, intelligent, successful teacher will be sensitive to the personality difficulties of her pupils and will try to help them overcome their troubles A worried child is sadly handicapped, but often a teacher does not see that anything is wrong A good teacher must be something of an amateur psychoanalyst, at any rate to the extent that she understands the importance of mental hygiene If a child is failing because of emotional disturbances and problems, it may be that the united efforts of parent, teacher, and physician can resolve the difficulty It is certainly often enough a condition of tragical importance to the child and one which should not continue if there is a remedy

14 *Budgeting pupil's time* One of the lessons to be learned in taking care of individual needs is that children often waste their time because they do not understand how to apportion or properly distribute their tasks. Both in group meetings and in individual conferences, a rural teacher, or any teacher, should take whatever time is necessary to show pupils how to use their study periods to greatest advantage When to do this piece of work, when to do that, how to save time, when to do the hardest and when the easiest—all this should be considered by the teacher as a part of individualized instruction.

15 *All should get essentials* If possible every child should be able to master the essentials, that is, to learn the lowest level of assigned work It is highly important that the teacher know what the bare essentials really are In learning this the state course of study should be of greatest service Some textbooks attempt to grade the materials in some subjects In spelling we

now have minimum lists for each grade In reading the slow child may be able to read only one book while the bright pupil reads several By the use of some of the modern standardized tests it is possible to discriminate certain fundamentals from a richer content of materials.

16 *Collections of commercial materials.* Rural teachers should be alert to find published study and learning helps of a truly educational character which will aid them in carrying on the work of individualized instruction It is important to distinguish the genuine from the spurious, and often the advice of superintendent or supervising teacher should be secured before coming to a decision to make any purchase If any teacher, above all others, needs individual study helps, it is the rural teacher In reading her professional magazine the teacher should not overlook the advertisements, although some advertised teaching materials are hardly worth buying They are made chiefly to sell.

17 *Workbooks and practice manuals* These are now published for every grade of school work, not excepting the first Every rural teacher should make use of workbooks, but she should use them with judgment and caution All such work needs to be supervised and checked by the teacher None of these instructional materials are absolutely foolproof There are now fine workbooks in arithmetic, language, reading, history, civics, geography, agriculture, nature study, the social studies, physiology, and other subjects

18 *Use of check tests* It is very common now for rural teachers to make use of a great variety of objective check tests, this is a procedure which can be overdone However, in the work of individualized instruction the teacher will need to make use of such tests, but she should do this judiciously and not too freely. Pupils can learn how to prepare and use such tests by themselves It is well for the teacher to have on hand a large collection of objective tests which are well organized, classified, and easy of access Check tests are found in workbooks and practice manuals.

19 *Monitorial assistance* Many rural teachers who are making use of individualized procedures find that it is quite practicable and advisable to employ a system whereby older pupils or brighter pupils are able to assist younger or slower pupils in many different ways If the teacher is very particular to give careful directions and if she also supervises her pupil assistants, it is entirely possible in this way to carry out her teaching procedures successfully and satisfactorily This plan must not be overworked, helpers must be carefully chosen, and the kind of work done under pupil supervision, or checked by pupils, must be selected with good judgment.

20 *Progress charts and achievement graphs.* Such charts and graphs are now exceedingly common and are found in many workbooks and practice manuals. The teacher should instruct each child how to keep his own individual chart, of course the teacher will graph the status and progress of the entire group Such graphic representations of daily or weekly achievements are now used particularly in spelling, in the fundamental skills of numbers, in silent reading, in language, and in other subjects. Teachers also use charts to show the responses of pupils in health activities, in civic enterprises, and in various conduct and character achievements

21 *Educational materials for younger pupils* One of the chief problems of the rural teacher is to provide enough material of an educational character for the primary pupils If the teacher knows the teaching-learning objectives which she should be trying to realize, she will be able to select more intelligently and wisely Here is an opportunity for much individualization; here is a type of educational guidance for which the teacher should prepare with care. There are now plenty of educational games and plays which should be utilized The teacher should read some of the various books and manuals dealing with primary activities, such, for example, as *Pupil Activities in the Elementary Grades* by Ruby Minor [1] Here are activities for all grades from the first to the sixth The last chapter deals with "Rural

[1] J B. Lippincott Company.

School Activity" There is an excellent bibliography at the close

22 *Overdoing the written work* The rural teacher, in her zeal for individualized study and through the use of individual workbooks and other individual study materials, should be careful not to require too much written work In fact, it is not a good thing to require more written work than the teacher can at least inspect with some care Individualized teaching may degenerate into nothing more than the doing of an endless amount of written work at the seats, much of it carelessly prepared and of little value It is much better to have less in quantity with a higher grade of quality Pupils should always be encouraged to do their best

23 *Know what each child is doing* It is unsafe not to know *what* each child does during his study time and also equally unsafe not to know exactly *how* he does it If children are to acquire good work and study habits, their work must be supervised from time to time Children easily fall into incorrect ways of doing things, a word of caution or direction at the right time will save a good deal of difficulty later on The successful rural teacher almost unconsciously takes note of what the children are doing at their seats She is not meddlesome and she does not irritate She merely supervises and directs to save waste of time and effort and to secure the desired educational results

24 *Reading and following directions* One of the functions of the school is to teach children to read directions carefully, to understand them, and then to do exactly as the directions indicate In the use of various study materials, such as workbooks and study guides, there are always specific directions Teachers should go through these from time to time as necessary with the children in a class exercise and often when needed with individual children To make individualized instruction successful, children must learn to work independently and to get results In order to do this they need certain silent reading skills Here is an opportunity for the teacher to do both group and in-

dividual teaching until each child is able to do what needs to be done

25 *More, but also better* Not infrequently it happens that teachers feel that all that is necessary for the brighter pupils is to give them more work of the same kind. So they merely give a greater number of the same type of questions to be answered This is not the correct way to solve this problem. If a teacher uses a two-level assignment, then the higher level should call for a higher type of activity If the questions of the lower level are mostly memory or fact questions, then the upper level should comprise many problem questions and also many projects which will call for a higher type of ability In the assignment of library readings there is opportunity to make use of the same principle. The pupils of less reading ability will necessarily be restricted to certain types of books, but those children who are skillful silent readers and who read with comprehension can be assigned reading materials of a much richer content In using individualizing methods the teacher should strive to give the brighter pupils a richer course, even though they must keep step in essentials with the slower ones Sometimes it is advisable to let superior children push on and finish the eight grades in less than eight years

## REVIEW, TEST, AND PROBLEM EXERCISES

1 Why may failure in school work be a tragedy for the individual? How can this be avoided or mitigated?

2 Can a rural teacher make any use of the principle of ability grouping? State three advantages and three disadvantages of this plan

3 What features of the Winnetka and the Dalton Plans are adaptable to use in rural schools?

4 Make out a twenty-question pretest to be used before beginning the study of the physical aspects of the geography of South America, as an entire continent

5 How can a rural teacher use the recitation period, so-called, as a means of promoting individualized instruction?

6 Give your idea of an ideal report to parents, to be made out and sent, say, once in two months

## REFERENCES FOR THE TEACHER'S READING AND STUDY

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# CHAPTER XIX

## UNIT PLAN OF TEACHING AND LEARNING

**Introductory considerations.** Today we find in America two schools of thought about teaching and learning On the one hand, there are those who advocate the systematic acquisition of knowledge, skills, and appreciations through the study and mastery of the subjects of the curriculum, on the other hand, are the activists who believe that children learn best when subject matter is used as a means rather than as an end in itself. The activity unit and program are considered in the next chapter It is enough to say here that the proponents of the activity unit are increasing in number Teaching and learning through the use of integrated, meaningful wholes or units, whether they are subject units or activity units, is making steady progress in this country The use of either subject units or activity units is a long step in advance of the old assign-study-recite method of the traditional school in which the emphasis was almost entirely upon the mastery of textbook subject matter In this chapter the term *unit* has reference to the integrated subject unit through the use of which genuine insightful learning takes place That is to say, the materials of study are organized and presented in such ways that the learner secures genuine understandings and insights The pupil or student has an "attitude of intelligence" He sees and appreciates relationships rather than merely amasses a body of unrelated factual materials

**Our puzzling terminology.** At the present time there is such a multiplicity of terms used in relation to teaching-learning procedures or techniques that the average teacher is greatly confused and often gets wrong conceptions of what is implied. The old word *recitation* now comprises so many processes and activities that the young teacher needs carefully to compare

the traditional meaning with the modern greatly enlarged meaning Dr Roy O Billett in *Monograph No 13* of the National Survey of Secondary Education discusses the perplexing nomenclature so far as plans characterized by the unit assignment are concerned. He mentions the Morrison Plan, the Dalton Plan, the Winnetka technique, differentiated assignments, long-unit assignments, individualized instruction, contract plan, laboratory plan, problem method, and project method There are many modifications and combinations of these plans or methods, and they are in use to a greater or less extent in our elementary and secondary schools There are project units, problem units, subject units, and activity units This chapter treats of integrated, meaningful subject units largely as the teaching-learning procedures have been developed by Dr Henry C Morrison

**Unit plan not new.** The use of large units of subject matter is not of recent origin, by any means Dr Morrison did not invent the unit plan of teaching as some teachers seem to think He did develop the mastery idea and the five-step teaching cycle or procedure through which teaching and learning become more exact and more effective However, some fifty years ago Charles A McMurry began his work on carefully organized typical subject-matter units, particularly in geography and history Those of us whose memory goes back thirty years or more recall these famous large, logical, subject-matter units very well They were distinctly not like the modern integrated subject, problem, project, or activity units Over a generation ago educational thinkers realized that the mass of materials in many school subjects should be more logically arranged into large type units. By the use of such types it was believed that the pupil would be able to derive general principles which he could use in learning other similar subject matter Dr. McMurry believed that the use of large typical units would not only teach the pupil to acquire a more usable body of knowledge, but would also result in the pupil's acquiring greater power to apply such knowledge in thinking With McMurry the great objective was the development of the general notion or concept, with Morrison the central

idea is insightful learning which results in change of personality.

**Nature of the learning units.** A unit of subject matter for teaching-learning purposes is more than a topical, logical analysis of related items It is a comparatively large organization of related materials to be learned or acquired, in which the unitary principle has direct relation to the pupil's understanding, appreciation, and mastery Morrison says that a learning unit is "a comprehensive and significant aspect of the environment, of an organized science, of an art, or of conduct, which being learned results in an adaptation in personality "[1] When such a unit is mastered the result is a change in the child's understandings, attitudes, and appreciations, in short a modification of behavior controls Ruediger[2] tells us that "A unit is any division of subject matter, large or small, that, when mastered, gives one an insight into, an appreciation of, or a mastery over, some aspect of life " A significant meaningful unit may be in the nature of a problem or a project and the acquisition or mastery may result in a change of ideas, ideals, or habits There are knowledge units, appreciation units, and skill units Roy O Billett in *Bulletin, 1932, No 17,* gives this definition "The unit is best regarded as a concept, attitude, appreciation, knowledge, or skill to be acquired by the pupil, which, if acquired, presumably will modify his thinking or his other behavior in a desirable way " It thus appears that Morrison and Ruediger define the learning unit in terms of subject matter while Billett uses words that relate to the subjective changes in the child's personality In these three definitions we observe that the central conception or objective is concerned with actual modification for the better of the pupil's personality That is the acid test of a learning unit A good unit increases the student's intellectual independence and his ability to work effectively Units are not fixed quantities either in size or nature They vary according to the character of the subject matter and the controlling educational objectives The best units are made by the teacher herself,

[1] MORRISON, H C —*The Practice of Teaching in the Secondary School,* University of Chicago Press, Rev Ed 1931

[2] RUEDIGER, W C —*Teaching Procedures,* Houghton Mifflin Company 1932

they are modified as the conditions and needs of the given class and teacher require There is no such thing as a perfect, standard, finished unit, but every teacher will find it helpful to provide a variety of units for their suggestiveness

**Units and unit assignments.** The unit may be thought of as the knowledge or skill or appreciation to be acquired, the unit assignment may then be viewed as the pupil's experiences or activities which are needed in order to achieve the desired knowledge, skill, or appreciation Billett says that "The unit assignment consists of the suggested or required activities and experiences planned by the teacher to enable the pupil to acquire the desired concept, attitude, appreciation, knowledge, or skill" This writer states further that "the unit assignment should be differentiated to take into account such factors as the abilities, interests, needs, previous experiences, and immediate environment of the pupils for whom it is planned" It is a question of means and end The end or the aim is found in the psychological nature of the unit, and the means are the various learning procedures through the use of which the pupil reacts and responds and thus acquires the knowledge or attains the desired skill Teachers should always carefully distinguish means and ends. Many times these are confused Suppose a teacher wishes to develop skills in the use of the dictionary First she must know exactly what skills are needed, then she must work out a system of learning procedures which will produce the skills Dictionary skills are merely one phase of a great number and variety of study abilities, gradually attained by daily practice through the elementary and the secondary school Here is a large, comprehensive learning unit the mastery of which requires years of experience

**Integrated units and activities.** In his books, *The Normal Mind* and *The Wholesome Personality*, Dr Burnham has a good deal to say about the integrated personality He states that "The most fundamental characteristic of normal human personality is unity, wholeness, integration" Integration is the process of forming a related, unitary whole In their teaching-

learning processes, school people have been fond of differentiating subject matter and splitting it up into isolated, and often unrelated, subjects and topics. Knowledge and skill have usually been acquired apart from their natural setting where they could function in actual life situations. In an integrated learning activity, situation, or unit, on the contrary, the child acquires knowledges, skills, and appreciations when and as he needs to use them. His activities have purpose and meaning because of the realization of a felt need. There are useful problems to solve; there is a worthy project to be consummated. The child feels that his activities are intended to accomplish desirable personal ends or objectives.

Those who advocate the exclusive use of an activity curriculum maintain that the activity learning unit is the only truly integrated unit. When teaching and learning are carried out according to this activity program the usual school skills in reading, writing, number, and other subjects are acquired not through direct drill procedures, but as incidents of the social activity of the children. Adherents of the subject-unit plan of instruction also claim that by the use of meaningful, significant units of subject matter integration of the learning processes is also attained. In using subject units, integration is more likely to obtain if the learning activities are the result of efforts to solve a truly significant problem. It seems to be particularly true that large units of the Morrison type, in which learning is carried to the point of understandings, insights, and genuine mastery, are at least of a highly integrated character. The use of large problem units gives undoubted meaning and purpose to the learnings which the pupils thereby acquire.

While the activity people make great claims for integration, it seems clear that the use of the better types of subject units do give children not only more comprehensive understandings, but also those other developments of personality which are so important if pupils are to gain the conduct controls necessary for successful, satisfying living in our time. Very likely in no distant day we shall see an eclectic system of techniques in which

the more useful permanent values of the different schools of thought will be brought together into a plan which the average teacher will be able to use successfully

**Problem and project units.** In Chapter XVII the student will find a discussion of the general nature of problems and projects and their relation to thinking and motivation. In this section problems and projects are considered as learning units Such units are now widely used in the schools of America and have done much to motivate teaching and learning as well as to make more certain the acquisition of knowledge, skills, and attitudes It is evident that activity units are derived from project units; it is also true that subject units are often in the nature of problems In working on a subject unit it is often advantageous to make use of different activities or projects as part of the assimilatory or study steps when pupils are trying to get clear and comprehensive understandings and appreciations It is quite usual in the better schools to employ excursions and experimental studies, as well as various forms of expression, such as talking, writing, dramatization, drawing, sketching, reporting, debating, and other means of enlarging and intensifying insights and understandings Problems and projects are very often combined, so that the term problem-project unit or procedure would be a more accurate designation The use of problem and project units in the social studies, including history, geography, civics, and health, as well as in agriculture and nature study and in other types of subject matter, will insure greater interest, better motivation, more effective learning, and more certain development of conduct controls

**Selecting and organizing units.** It is now possible for teachers to find a great variety of learning units which are selected and organized from the teaching-learning point of view That is, instead of being merely a logical arrangement of related topics, these better types of units are developed with the central idea of the pupil's comprehensive, intelligent understanding of them Subject-matter outlines are one thing, but a well-organized learning unit is something entirely different. In developing a

teaching-learning unit, the governing objective should be the educational end products or personality changes which should result from the mastery of the unit The question is not how exactly and artistically the subject matter is arranged, as subject matter, but rather how completely the pupil is able to grasp the unit in its entirety and its details so that his behavior will be permanently modified because of the assimilative thinking which accompanies and is a part of the mastery of the unit. The teacher will find it necessary to construct her units for particular groups of children and to modify them whenever conditions and needs demand such changes Psychological rather than logical principles should govern selection and organization of units. A functional arrangement with the child's needs in the foreground should take the place of any merely topical analysis.

If teachers will write to W F Quarrie and Company of Chicago, publishers of the *New World Book Encyclopedia* or to The F E Compton Company of Chicago, publishers of *Compton's Pictured Encyclopedia*, they will be able to get very useful illustrative materials on many types of learning units The Child Development Foundation, Inc , of Chicago, publishers of *Foundation Classroom Materials,* also issues interesting and usable learning units in the social studies In selecting and organizing learning units, the use of large, controlling, motivating, problem questions will frequently furnish the core around which the materials to be learned can be arranged so that they will be more readily understood and retained as a "significant, and comprehensive aspect of the environment"

**Advantages of large units.** In general, it may be stated that, among the benefits arising from an intelligent use of large meaningful units of learning, particularly when they involve problems, projects, and purposeful, integrated, lifelike, child activities, the following stand out as evident values. (1) There are more intelligent and more highly developed understandings, appreciations, and insights. (2) Pupils in most cases manifest a greater inherent natural interest, thus the entire learning enterprise is more adequately motivated (3) Teacher and

pupils are impelled to make increased and more effective use of available reference books and other learning accessories and materials (4) The various study skills are more likely to be developed by this system than by the use of traditional methods. (5) Children learn to form opinions, to pass judgment upon statements, to draw conclusions, or to wait until more data have been secured Facts are used as material for productive thinking. (6) One of the best by-products of the unit plan, involving the use of problems, is that pupils form the problem attitude and habit of mind. Increasingly they acquire the power to sense problems and to formulate them (7) In the process of gaining new and larger understandings the pupil finds himself in constant need not only of formulating problems but also of solving them. Problem solving becomes one way of meeting life to the intelligent child, he learns to do it as a matter of course (8) Not only is the child interested in his activities, but he likewise develops life interests which will have an important influence upon his subsequent career (9) Expression in oral and written language and in numerous other ways is a component part of the unit plan. There are not only expressive activities during the so-called recitation period, but expression is also one of the means by which assimilation takes place during study. (10) When the plan is flexible, as it should be, provision is made for varying abilities. Thus there are fewer or no failures because each child can be successful upon his own level of accomplishment.

**Dr. Morrison's notable influence.** In 1926 Dr Henry C. Morrison's large volume entitled *The Practice of Teaching in the Secondary School* first appeared A second edition was published in 1931. This author thinks of secondary education as beginning with the fourth grade In the first three grades children secure some skill in the two tools which they are to use throughout the secondary school, namely, reading and writing They have also attained a beginning in number adaptations as well as made the primary social adaptations The best summary of the essential features of the Morrison unit plan is probably to

be found in *Monograph No. 13* of the National Survey of Secondary Education. It was written by Roy O. Billett, a member of the general survey staff.

While Dr. Morrison did not invent the learning unit, the comprehensive system of teaching procedures which he describes in his widely studied book has probably done more during the past few years to raise the level of instruction, particularly in high schools, than any other single plan of techniques. Charles A. McMurry considered the ultimate goal in the use of his type subject-matter units to be the formation of general ideas. He believed that the use of such large type units, especially in geography and history, would result in the better acquisition of systematic knowledge as well as in forming more effective habits of thinking. Morrison goes much farther than McMurry in his detailed analysis of a complete system of unit instruction.

Morrison has enlarged our conception of the organized learning unit, he has given us an expanded and developed idea of the nature of mastery. He has also broadened and intensified the meaning of independent study and of the acquirement of intellectual interests and intellectual independence. Study to Dr. Morrison comprises much more than most teachers have understood it to mean in the past. Study means a large number of specific skills in silent reading, in speech, and in forms of written expression. It involves a variety of thinking or problem-solving abilities on varying levels and in different types of subject matter, for example mathematics and the social and physical sciences. Study also employs the power to interpret and to appreciate truth and beauty in literature and the fine arts. Study includes the development of personal self-control and habits of steady application in the presence of difficulties until the task is finished. It is true that the advocates of the extreme activity program say that the Morrison technique stresses subjects too much as such, and that the mastery units are not adequately integrated, yet it remains true that the Morrison system includes the use of problems, projects, and activities in a far more systematic way than any plan previously proposed.

**Morrison's mastery principle and technique.** Morrison has given us a new understanding of the word *mastery*, he has demonstrated the fallacy and the futility of the so-called *passing grade*. Pupils either know and understand or they do not know and understand the unit, according to Morrison. Whether the unit is in the field of knowledge or of appreciation or of motor control, that is, of skill and habit, the Morrison technique is to *pretest, teach, test, adapt procedure, teach and test again to the point of mastery*. By mastery Morrison means a really new insight into related meanings, for example in the natural and the social sciences; moreover, this insight and understanding will include a change of attitude and a modification of behavior. Morrison believes that some things can and should be learned "for keeps." Tests for mastery may be both oral and written, they may also be both objective and subjective. The new objective test is widely used, but many teachers now feel that other types of tests should also find a place, including the old essay type. Tests for attitudes, habits, and adaptations cannot, in the nature of the case, usually be of a direct form. Real tests of attitudes and appreciations will often be indirect and not closely related to the use of the subject materials. A pupil's attitude may often be judged best by noting the effect of his learnings upon his future conduct. Some critics of the Morrison procedure maintain that mastery is a relative affair and that absolute mastery, except in certain special fields of learning, should not be expected. There are certainly many levels of achievement in the field of skills and of appreciations.

**Five- or six-step teaching cycle.** In its unmodified form, as used in the science-type unit, which includes the science subjects, social studies, and mathematics, the teaching procedure comprises five steps, namely—exploration, presentation, assimilation, organization, and recitation. The exploratory step is in the nature of a pretest, quiz, and general class discussion for the purpose of discovering what the pupils now know and understand concerning the new unit, so that both teacher and pupils will become oriented in relation to the next field of study. The

teacher may ask testing questions, not for marking but rather for uncovering each student's mental background As a result of this exploratory process, some class members may be excused wholly or in part to do other work In many schools, however, nobody is excused This part of the procedure should show pupils their needs as a preparation for further instruction This pretest will usually bring to light many misconceptions and difficulties

The second step is a preview and an overview in which the teacher presents a sketchy but clear and concise bird's eye view of the entire unit This requires skill and should be well done Only significant, highly relevant, and related essential concepts of the unit are given for the purpose of outlining a unity of understanding The picture is not complete and the students will fill in the outline during the next step of assimilatory study The teacher's presentation should be so well done that pupils will not only be prepared for independent study but will also be stimulated to go to work on the unit Sometimes a re-presentation may be necessary.

In the third step teacher and pupils work together in various study procedures The teacher supervises and directs the study activities of those who need help When a common difficulty arises, the teacher clears up the matter for the entire group. Pupils read, write, draw and do whatever else may be needed to master the unit During this period of assimilation pupils are furnished with "guide sheets" containing reading references, list of projects, and an outline of essentials, problems, questions, directions, and whatever else is necessary to assist the student in mastering the unit As the study activities proceed, individuals are tested from time to time for mastery This third step may require several days for its completion As mastery tests are successfully passed, pupils go on to their own related projects, reporting these later to the group A variety of tests, oral and written, objective and subjective, are used It will be seen that by providing additional supplementary projects, activities, and assignments of readings, the teacher makes provision for varying grades of abilities

When the teacher feels that the entire class has mastered the unit, there is a meeting of all for the purpose of making a coherent, well-organized sketch of the constituent parts of the unit. Pupils do not use any notes or references, and the guiding principle is not to present an array of facts but rather a unity of related understandings Teacher and class work together The finished outline shows in systematic form the central ideas and the subordinate related ideas which the pupils now possess as their own understandings This step may require a few minutes or perhaps one or more class periods

The fifth step in the Morrison teaching cycle is called the recitation. The teacher has made the first presentation of the entire unit at the beginning of the study, but now pupils give floor talks on the whole or on portions of the unit Sometimes there are discussions of these talks, and sometimes the subject is debated Occasionally the unit may be dramatized, and in agriculture, physiology, nature study, and geography some pupils may give experimental or other demonstrations. In agriculture in a country school there are many opportunities for such forms of recitation General discussions and written and oral reports are common Illustrative sketches, graphs, charts, pictures, and the like may be used advantageously. The recitation may take from a tenth to a quarter of all the time In most of the schools the mastery test follows the recitation but it may come in connection with the step either of assimilation or of organization.

In some schools, instead of using a testing procedure as part of the assimilation period, teachers provide a test for mastery as the final or sixth step after the recitation In a few schools, according to the survey bulletin, the teacher sometimes gives a summarized review of the entire unit after the recitation is finished. This seems to be a wise part of the general procedure and should insure better results in a final testing exercise

**Adaptations of Morrison procedures.** It is entirely possible and practicable to make use of a modified form of the Morrison unit plan in rural schools It is not necessary to use all of the

five or six steps and they should never be used in any formal fashion Moreover, whether or not all the steps shall be used, the manner of using them will all depend upon the type of subject matter For example, the Morrison formula applies very well in the teaching of history and geography, but modifications will need to be made for teaching arithmetic and language The best thing for a rural teacher to do is try out the unit plan first with one subject and one class, gradually using such procedures more and more if and as she finds them successful The use of integrated units at the present time in the social studies is very common and not difficult It is possible to purchase commercial units of high quality If the rural teacher will think of the presentation step as an overview, of exploration as a pretest, of assimilation as directed study in its broadest and best sense, of organization as the making of an outline with related understandings and learnings as the guiding principle, of the recitation as a time for purposeful discussions and of practice in the language arts—if a rural teacher views the Morrison procedure in this way, she will see that it is a perfectly natural series of teaching steps which can and should be used

Many rural schools are now using mastery tests, most of them are the new-type objective tests Often the rural teacher hectographs copies of these tests Such tests should be used whenever needed, whether in connection with the assimilative study period or following the recitation Whether these tests merely measure memory results or whether they also disclose various abilities, skills, habits, attitudes, and adaptations will depend upon the character of the tests and the ways in which they are used As a rule objective tests need to be supplemented by various other means of ascertaining the child's development and progress Often the writing of a paragraph or a very short theme will enable a teacher to judge a pupil better than by using informational tests In the rural school probably no pupil should ever be excused from work as a result of the pretest Instead, every child should be given more to do on the same unit, more assimilative material on the level of the pupil's ability, often in

the nature of useful projects or library readings. In making use of the first step, the rural teacher should repeat the unified overview until all normal pupils get it In a rural school where classes are small there will be but little difficulty in preserving the class unity Provision should be made for brighter pupils by enrichment of the materials used In general, a rural teacher should begin the unit plan in the social studies in different grades

Every rural teacher, because of her close association with her pupils, can know a great deal about each child, physically, mentally, and morally It is a good plan to have a strong manila envelope of good size for each pupil Then some cards which fit readily into the envelope should be used; on these cards the teacher should carefully record all physical and health tests, the results of intelligence and achievement tests, and whatever else that is useful pertaining to the personality and the progress of the individual. It would be very useful to keep this envelope with its record cards all through the grades Statements as to attitudes, habits, and general character attributes should be set down from time to time for guidance When the county nurse or possibly a physician or dentist makes examinations the results should be recorded In short, such an envelope will really give a complete history of the child which will be of the greatest value in guiding and directing his learning

**Advantages of the Morrison plan.** Although a number of criticisms have been made of the Morrison plan from time to time, it nevertheless remains true that the general idea is a decided improvement upon traditional school practices Some critics have mentioned the associated expense, but this need not be true in a rural school of say fifteen to twenty-five pupils The expensive thing is pupil failure, under this plan the number of failures is reduced Even if the mastery formula cannot be completely worked out, the striving for a higher type of mastery will, in itself, be advantageous The use of any unit plan will require intelligence and effort on the part of the teacher, but unless a rural teacher is willing to learn and willing to work, she

should not be retained However, no teacher should plan more than she can do well and without undue expenditure of time and energy As a matter of fact, the unit plan, when it is once in operation, is a time saver for the teacher But she will need to make careful plans, and to be systematic and persistent The best way is to introduce learning units very gradually So far as marks are concerned, the teacher should be particular not to disturb parents unduly If the percentage system is used then this may be supplemented from time to time with other means of acquainting parents with the child's progress. This problem is discussed in a later chapter. In any event, both parents and teachers should understand the fallacy and the futility of the "passing grade" In every rural school the teacher should try to develop a spirit of mastery The best modern reports to parents give much more than a list of per cent grades on subject matter

In using a unit plan with problems and projects, pupils usually manifest decidedly increased interest While there is also much individualized study and learning, the class-discussion feature is retained, this is of course a distinct socializing advantage In general, the integrity of the group is maintained but not at the expense of the individual Because of carefully directed study and the repeated use of mastery tests, failures are not common Perhaps less ground is gone over, but pupils acquire more knowledge and greater skill The inducement to laziness, indifference, and lack of preparation, is greatly reduced as compared to the assign-study-recite system The plan provides for a variety of practices in the different types of subject materials and this increases efficiency, interest, and accomplishment The Morrison technique is a dignified, businesslike enterprise in which learning becomes a serious and important undertaking This system, in itself, exerts a salutary influence upon pupils, the concomitant learnings are of lifelong value Each pupil or student is given the benefit of diagnostic measurements in order that his case may be understood by the teacher so that proper remedial or corrective steps may be taken All in all, the Morri-

son plan has done much to lift teaching and learning to a decidedly higher level, its central idea and general technique should be utilized in rural schools as much as possible

**Motivation under unit plan.** One of the constant problems of every teacher, and particularly of the rural teacher, is so to conduct the work of her school that her pupils will wish to study and learn because of natural inherent interests It is undoubtedly true that children are more interested when they are actually participating in the activities involved in the use of integrated learning units When problem, project, and activity units are used, the very nature of the lifelike learning processes usually insures adequate interest and motivation But there is no reason why subject units should not make use of problems, projects, and activities In fact, Dr Morrison's system provides directly for such self-motivating, pupil participation, the emphasis upon understandings and insights lifts the procedures above merely memoriter lesson learning and hearing When children are engaged in really getting a genuine understanding of significant, useful, worth-while units of subject matter, they are quite likely to be inherently and directly interested Efforts actually to master something are interesting to every normal child Children delight in the attainment of skill They enjoy the necessary repetitions of well-motivated drills if they can feel a continual gain in control, mastery, and skill

In using either the Morrison plan or some adaptation of it, the responses of the pupils are a certain indication of their interest It frequently happens that pupils choose projects and problems to work out after the minimum masteries have been made Much depends upon the personality and skill of the teacher In fact, a good teacher can make a success of almost any method But in using the unit plan, there is ample opportunity for individual diagnosis and remedial work Such personal direction and guidance is a part of the general procedure The good teacher will keep her eye upon pupils who are not getting the idea or who for some reason are indifferent and inactive During the step of assimilation, which takes over three fifths

of the total time for the entire cycle, the teacher can and should study and work as much as necessary with individuals This is the period for both group and individual supervision of study. Now is the time for the teacher to find out how pupils work and to show them better and more effective methods of study

**Provision for varying abilities.** In *Monograph No 13*, mentioned previously in this chapter, reference is made to differentiated assignments It is significant that Dr Morrison, himself, makes no provision for varying abilities except when he suggests the use of additional problem-projects for those who can do more than the average of the group This, of course, is entirely in keeping with the idea of mastery However, Dr Billett states that in over two thirds of the high schools with which the survey deals, "separate assignments are provided for on each unit for each ability level" "The typical number of levels provided for is 3, the range being from 2 to 4 levels." Following is a summarized point by point statement of the various means employed to adapt unit instruction to different capacities. These suggestions are a result of the responses from the high schools included in the survey and they are adaptable to elementary and rural school conditions

1. The majority of good teachers everywhere find it desirable to make use of differentiated assignments whether they use the unit plan or some other

2 Within the assignment on a given level of attainment, it is quite common to permit pupils some choice as to which problems or projects they shall work on

3 In allowing a choice of assignments, many teachers restrict the plan of individual preferences to pupils of the better grades of intelligence However, all pupils should be given some choice

4 It is customary to require each pupil to begin with the lowest assignment and to work up as far as possible

5. In some schools teachers determine the point of beginning, occasionally a teacher permits the individual pupil to choose where he shall begin While individual freedom should be encouraged, pupil guidance is necessary

6 In ascertaining a pupil's level of ability and assignment, it is the usual practice to use different criteria for judging a pupil's ability

Mental tests are common, but should not be used exclusively A child's health and strength and his personality attitudes and habits should be given due weight

7 In differentiating assignments, the amount and the kind of work required should both be taken into the account Slower and less bright children may be given less to do and easier types of materials

8. In many schools a complete list of problem assignments is arranged with the easier ones at the beginning and in an ascending scale of difficulty. Then pupils work on as many of these problems as their individual abilities make possible

9 It is also quite common to assign to each problem or project a scale-point of achievement value The accomplishment of each child can easily be graded in this way

10 In any graduated system of differentiated assignments and instruction, every child, both dull and bright, should progress as rapidly and as far on his own level as his abilities will permit No dull child and no bright child should be slighted

**Function and value of a textbook.** The rural teacher will find that a first-class textbook is an indispensable means or tool for teaching and learning, whether she uses the unit plan or some other In using the unit plan, a good text in arithmetic, for example, will serve as an excellent and entirely sufficient guide sheet In teaching the social subjects, such as history, geography, and civics, it is highly desirable to have several sets of textbooks for daily reference Some mature, well-trained, and experienced teachers may find it possible to use their own outlines and thus to dispense with a basal text, but most rural teachers cannot and should not do this The rural teacher should have the best texts that are on the market, then she should use them intelligently No doubt the state or the county will furnish an outline course of study; in some states very detailed courses are now furnished, particularly in the social studies When this is the case, the teacher will usually find it necessary to make use of many references in order that pupils may secure the needful information It is now common in the better texts for authors to furnish good outlines, summaries, and test questions Teachers should take advantage of such materials for all they are worth The best plan is for the rural teacher to make use of a modified

form of the unit idea in which the scientific up-to-date textbook will find a prominent place.

**Testing—marking—promoting.** Whether a rural teacher uses a unit plan of instruction, any other single plan, or a variety of plans, she is certain to give various tests, to mark papers, to grade pupils in some way, and to pass children on from one class or grade to another, according to her estimates of their progress in learning. No rural teacher should make use of inflexible regulations or systems or cast-iron methods of any sort. The chief consideration always is the welfare of the individual child at any given time and all the time. He may be dull and he may be bright. The teacher is in duty bound to do her best for each pupil regardless of heredity, environment, or personal handicaps. Tests should be given when they are needed and as often as they are needed. There is no inflexible rule. The needs of the child in his relation to particular units of materials are the chief criterion for judging. The principle of mastery is a good one to follow. The ideal of mastery should supersede any foolish notion that there is virtue in any passing grade of any type, whatsoever. The fallacy, futility, and foolishness of the idea of the "passing grade" as any mark of completion of any unit of work should become thoroughly ingrained into the teacher's consciousness as a constant guide in all her teaching-learning activities. The most useful of all tests are inventory and diagnostic tests because of their direct bearing upon learning processes.

An experienced rural teacher understands that most of her tests call for informational materials, usually textbook facts. It is not so easy to test a child's habits, ideals, attitudes, skills, and appreciations. But in some way a teacher should determine not only what a child knows but also what he can do and how well he can do it. A pupil's conduct, or general behavior, or specific behavior under special conditions or in particular situations will often shed much light on the child's ways of thinking, on his attitudes, his likes, and dislikes and on other very important elements of personality. Teachers should not restrict themselves exclusively to the use of objective tests. These are

valuable, but they should not take the place of other methods of ascertaining a child's personality and progress

Marks and marking are discussed more completely in the last chapter It is sufficient to say here that, whether a teacher uses percentages or letters, she should never let the marks come between her and the child In any event, a mark does not indicate mastery, as a rule Marks should not be the sole criterion in determining promotion Promotion or nonpromotion should be determined by the child's best welfare at the time His health, his attitudes, his maturity, his native ability, his industry, his home conditions, his physical development, his age, his previous school experience, the type of subject, and other factors should be considered along with the mark on the report card Reports to parents should give much more than a pupil's subject grade This problem is discussed in the author's *The Country Teacher at Work* In general, reports to parents should show how the child is progressing and what needs to be done in order that he may make better progress In the use of the unit plan of instruction promotions are often made if a pupil does the minimum assignments Of course this does not realize the mastery idea, that is, complete mastery of the unit When a series of units make up a year's work or a semester's work, in some school systems pupils are required merely to repeat the units in which they failed Of course this interferes seriously with our beautiful graded system, but the individual does not suffer so much

**Learning units in a rural school.** In a typical or average rural school, if the teacher is a high-school graduate and has had at least one additional year of professional training, there will be no great difficulty in introducing teaching-learning units into at least some of her classes If she can do this she will find that it is highly advantageous, but she must very gradually make the changes In such subjects as the social studies, including history, civics, geography, and in physiology, health activities, nature study and agriculture, and even in arithmetic a modified form of the five-cycle procedure, including the use of the mastery formula, is entirely possible.

The teacher should know comprehensively and in detail what the course of study for the state comprises, then she should carefully compare her textbooks with the topics in the state course to see what must be added and what omitted. It is essential that this rural teacher should understand what is meant by actually learning anything whether in the field of knowledge or skill or appreciation. She should know, also, that in order to teach a unit successfully she must have a good modern basic text and enough references in the subjects named above. In teaching such subjects as history and geography the more supplemental materials the better.

At the present time it is possible for the rural teacher to secure commercial units with detailed instructions as to their use. Such units in the various social studies are now common and many of them are also printed in magazines intended for the rural teacher. In using the unit plan, the teacher should have at hand a number of helps which the pupils can use profitably during the period of assimilatory study. This will include many problem questions and a variety of objective tests. In any case, however, the work of study must be carefully supervised and commercial workbooks must not be filled out in mechanical, unthinking fashion, as they often are. If the rural teacher will see to it that the study activities of her pupils are carefully supervised and if she will always provide a good supply of problem questions, projects, and activities in variety and with definite educational objectives, she will find that her pupils will learn more and better and that they will respond more freely and effectively in the recitation period.

Here follow some specific cases in the use of learning units in a rural school.

1. In teaching such a subject as *corn*, for example, a rural teacher can easily organize the materials on a unit basis and spend two or three weeks on the unit, with the use of many accompanying projects and activities, such as testing seed corn, selecting seed corn, making booklets, going on field trips, and many others. If her school is in the corn belt, she can well afford

to spend considerable time on such a unit The same thing is true of many other topics in agriculture, such as milk, cattle, poultry, soil, plant food, and forage crops. Nature study furnishes a large number of subjects

2 When a class in reading comes to a lesson on trees, a special unit study can easily be made The same suggestion applies to birds, foods, and historical and geographical topics The meaning of this statement is that when a teacher finds her pupils particularly interested in a truly pivotal learning unit, a real center of both interest and understanding, then is the time to strike while the iron is hot When a genuine inherent interest is aroused more fruitful learning will take place

3 In the study of language a well-conducted school paper may become the center of interest and of understanding In this way much useful knowledge will be acquired and many language and reading skills developed The school society, the 4-H and other clubs, and the midday meal, may well serve as natural centers for many useful learnings

4 A survey of the local district has many times been made a center of common interest which has not only furnished much valuable information, but has also developed reading and language skills and other abilities Directions for such surveys can be obtained from the Federal Office of Education

5 In conducting school programs of an educational character pupils have an opportunity to learn many things and to develop their knowledge, skill, and appreciation in the use of literary selections and in music and art Valuable learnings in reading and language are also of course possible

6 The *home,* as a social study unit in the first and second grades, by way of illustration, serves as a center which is now very widely used in many schools *Community life* and the *farm* are also used as units in the same way Practically all of the states now furnish materials to teachers on such units and on many others In the third and fourth grades the units are often Indian Life and Pioneer Life In the fifth and sixth grades beginnings are made in the study of American history, using

biography as a means of arousing an interest in personalities In the lower grades a great deal of guidance is necessary on the part of the teacher, and the social studies are closely associated with reading and language.

7 In using any unit, the teacher must continually consider the effect upon the pupil Is he getting understandings and insights? Is he actually participating? Is he developing ability to think, to draw conclusions, to appreciate meanings and artistic values, whether in people, in nature, in music, in pictures, or otherwise?

8 Some units can readily be used with several grades combined, say, the four upper grades, or the four lower grades. Birds, flowers, trees, and animal life might be used as units in which the entire school may have a share There are many different grades and levels of assignments of activities and projects

9 In some respects the rural school offers the best possible environment and situation for the use of problem, project, activity, and subject units because all of the children are under the teacher's control and because it is possible, due to small numbers, to supervise, guide, and direct the work of each child. When the unit plan is very carefully worked out and administered, the number of class exercises can be greatly reduced, a desideratum of great importance

10 In using the unit plan of instruction, the teacher will get the feeling that she and her pupils are really engaged in a profitable learning enterprise "Learning takes place when pupils are brought into contact with educative experiences on their level of learning ability" By using a five-cycle procedure in the upper grades, perhaps culminating in a sixth step or test for mastery, the pupils will actually have done a very worth-while piece of work The evidence is found in the answers to the problems, in maps, graphs, or drawings made, in outlines formulated; in tangible test results; in summaries and résumés, in valuable recitations of various kinds based upon materials really studied and learned, that is to say, *mastered.*

**Learning units illustrated.** Any rural teacher will secure many useful suggestions on the unit plan of teaching American history by studying *A Guidebook in United States History* written by Ira M Allen, Sadie J Palmer, and Ross H Smith, and published in April, 1935, by The Macmillan Company There is a *Teachers' Manual* to accompany the *Guidebook* which gives explicit directions and illustrations concerning the method of using the unit plan This manual also gives the answers to the tests Although this book may be more particularly adapted to pupils somewhat more mature than seventh- and eighth-grade pupils in the average rural school, yet both the *Guidebook* and the *Manual* are so suggestive and useful, that rural teachers are sure to find them helpful in learning how to use the unit plan. And in many rural schools they can actually be used in eighth-grade history classes

The Allen-Palmer-Smith *Guidebook* gives the following eleven general units for a year's work (the time limits are approximate).

"I. Colonization, 1000 to 1763, (4 weeks); II. Revolution, 1763–1783, (2½ weeks), III. The Constitution, 1783–1789, (2½ weeks), IV. Winning Respect at Home and Abroad, 1789–1815, (3 weeks); V Rise and Fall of Nationalism, 1815–1840, (3 weeks), VI The Nation Spreads Across the Continent, 1815–1850, (3 weeks), VII Secession and the Civil War, 1850–1865, (4 weeks), VIII The Recovery of the Nation, 1865–1884, (3 weeks),

"Units IX, X, and XI are developed vertically, they are not real periods of time that follow one another They are rather chronologically parallel trends or lines of development The time extends from 1884 to the present day

"IX Industrial Development

"X World Relations

"XI A Progressive Democracy

"The last three 'movements' should each be studied as a unit extending from 1884 to the present time Four weeks are given to the ninth, four to the tenth, and three to the eleventh. Total for the eleven units, 36 weeks"

Under the topic *Major issues* the authors say "The main purposes in your study of this unit (I) are stated in the following major issues You are expected to bear them in mind during all of your study of

the unit and your Organization of the unit will consist of writing satisfactory answers to these questions

"*A* How can we account for the discovery of America in 1492?

"*B* What various causes, social, economic, religious, and political, in Europe contributed to the colonization of North America?

"*C*. What lasting contributions to the institutional life of the United States were made by Virginia, Rhode Island, and Massachusetts?

"*D* What causes led to the downfall of the French Empire in North America?

"*E* What was the significance of the Peace of Paris, 1763?"

Among the dozens and scores of learning units used in elementary science and the social studies, we find the following· Weather and Climate, The Farm, Communication, Time, Social Insects, Indian Life, Frontier Life, Bird Study, Land Transportation, Water Transportation, Patriotic Holidays, Air Travel, Our Community Record, Clothing, Fur Industry, Food, Shelter, and so on to great length

In working out such a unit as *Our Community Record*, as done by the Child Development Foundation in their Classroom Materials, the following outline of topics is used: (1) Introductory Thoughts, (2) Specific Objectives, (3) Suggested Approaches; (4) Pictorially-told Community Record; (5) Suggested Outline of Content, (6) Personal Interviews, (7) Suggested Pageant; (8) Diorama; (9) Family Saga, (10) Permanent Community Record; (11) Activities, (12) Evaluations, (13) Bibliography Often problems for discussion and tests to determine results are given.

## REVIEW, TEST, AND PROBLEM EXERCISES

1 What is the essential difference between a unit of subject matter and a unit of understanding? Between a unit of interest and a unit of understanding?

2 Give illustrations of knowledge units, appreciation units, and skill units

3 Give an example of an integrated learning unit in the nature of an activity and another one that may properly be called a subject unit

4 Just why is the use of units, whether they are wholly integrated or not, a decided improvement on the traditional procedure? What was the nature of the traditional method?

5 Distinguish problem, project, activity, and subject units

6. Make out a detailed unit in eighth-grade geography which will last for one month of twenty days. Outline another one in history for the same grade and period

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# CHAPTER XX

## THE ACTIVITY PROGRAM IN THE RURAL SCHOOL[1]

**What is an activity program?** Ideas vary as to what is meant by an *activity program.* It is sometimes thought of as a sentimental kind of reasoning about child life Some think of it as an Eskimo village in the sand table, or a puppet show, or possibly decorations made for a Halloween party, or a live setting hen or a rabbit in the room. Others think that an activity program means letting the children plan and carry on the work of the school with the teacher in the background, or that the whole thing has to do with the organization of the school or with its equipment It is true that all these suggestions may have to do with the activity program, but to those educators who favor this new philosophy, for indeed that is what it is, it simply means doing away with some of the old ideas of the traditional school and putting into practice Dewey's philosophy of education—"the bringing of school and life together that the school may be life" If teachers are living with their children, leading them to live and work together, providing the happiest and most useful experiences for them, giving them the best possible, and expecting the best work from them, then they are indeed teaching by means of an activity program The plan stresses the art of successful and happy living together Some teachers probably feel that this program does not give enough emphasis to subject matter They think that incidentally some subject matter is taught but not much attention is paid to skills and techniques. The child is free to do altogether as he pleases about lessons.

[1] This chapter has been written by Miss Mildred B Richmond, professor of elementary education, Midland College, Fremont, Nebraska The activity unit was prepared and actually used by Miss Laura Knoell, teacher in the Belleview School, Dodge County, Nebraska The author gratefully acknowledges his indebtedness to Professor Richmond and Miss Knoell

This is a mistaken idea There are needed skills for this art of living, such as being able to read fluently with desired speeds, having essential number concepts, responding automatically and accurately to number situations, securing a command of English There are also other skills, attitudes, habits to be developed.

**Statements of authorities.** Let us consider what a few leading educators say about the "activity program"

1. W H. Kilpatrick *Education for a Changing Civilization*

This new curriculum consists of experiences It uses subject matter but it does not consist of subject matter The old curriculum consisted of subject matter set out to be learned for giving back on demand. The essence of the new curriculum is the child actively at work needing for his present experiences better ways of behaving It is in the step-up of these better ways of behaving that subject matter enters. It is thus that each succeeding new situation is met

2 Martha Porter. *The Teacher in the New School* [1]

First of all, I was conscious of the value of activity, not as a means to motivate the learning of certain predetermined facts, but as a natural function of childhood, as a means of growth and an indispensable accompaniment to intellectual interests

3 John Dewey *My Pedagogic Creed*

Save as the efforts of the educator connect with some activity which the child is carrying on of his own initiative, independent of the educator, education becomes reduced to a pressure from without It may indeed give certain external results, but cannot truly be educative Without insight into the psychological structure and activities of the individual, the educative process will, therefore, be haphazard and arbitrary If it chances to coincide with the child's activity, it will get a leverage, if it does not, it will result in friction or disintegration, or arrest of the child nature

4 California Curriculum Commission· *Teachers' Guide to Child Development Manual for Kindergarten and Primary Teachers* [2]

By the term "activity program" is meant a school curriculum which provides a series of well-selected activities for different levels of growth,

[1] Copyright, 1930, by World Book Company, Yonkers-on-Hudson, New York.

[2] Compiled by California State Curriculum Commission, Sacramento State Department of Education, 1930

which offers opportunities to children to engage in worth-while, satisfying experiences while carrying out their most worthy and most challenging purposes It provides an environment in which children continually purpose and act in situations of meaning to them, in which they live fully, richly, happily now, and so have the best possible preparation for living successfully after they leave school

5 C. W. Washburne· *Adjusting the School to the Child* [1]

Activities are the vital life giving part of the curriculum They are real education Giving the child a mastery of the three R's is important but it is mere training Education involves drawing out the child himself It is for this purpose that the group and creative activities exist

The group and creative activities include discussions but these are discussions of debatable subjects, not recitations on lessons all children have studied They involve work in appreciation of art, music, and literature when this work is not going to be tested or marked and is not to have anything to do with promotion—in other words, when children legitimately differ in what they get from the course The activities may include organized playground work, clubs, committees, and self governing assemblies They may include a school newspaper and a school bazaar They will always include creative expression through art, handwork, and informal English composition They may include dramatizations where the children write their own plays and make their own costumes And they will include a wide variety of projects which, while they often grow out of the individualized academic work and shed much light upon that work, are nevertheless an end in themselves

6. Fay Adams· *The Initiation of an Activity Program* [2]

An activity is a learning situation which meets the natural interest and felt needs of children and leads to better adjustments than the old traditional teaching methods

**Principles of an activity program.** The principles of the activity program are firmly rooted in the basic sciences of human life and growth If we make a careful study of the child and his

[1] Copyright, 1932, by World Book Company, Yonkers-on-Hudson, New York

[2] *Initiation of an Activity Program into a Public School*, Teachers College, 1934

development, we find certain prominent factors  The most important of these is ceaseless activity, both physical and mental, during the greater part of the day  The child is never passive, but he is rather quite persistent in his efforts to accomplish his purposes  As we observe this child we notice another characteristic, namely, his desire to organize his activity around centers of interest  In order to enjoy what he is doing he must

*Courtesy of Professor Richmond and Miss Knoell*

**A country school workshop**

have it related to some enterprise which he understands  He likes to do things with his hands  He thinks, as a part of his physical activity  We find him investigating his environment and then reconstructing places of interest to him  Why shouldn't our educational program be adapted to child nature since it is by his physical and mental activity that he learns? The activity program attempts to guide the minds and conduct of children in their natural ways of expression and to develop them to responsible and capable maturity

**Yesterday and today.** The school attended by our grandfathers with its barren environment could not stimulate desir-

able social activities and habits. Children learned the things mapped out for them by their elders. The work in school was organized by the teacher. She planned everything, took the responsibility, did most of the thinking, and judged the results. There was a great deal of activity on the part of the teacher but very little on the part of the child. There was memoriter use of books, and much formal drill. The check-up was of the question and answer type. It is not enough merely to read and study about the characteristic projects of civilization in which the child is to engage during his working and his leisure hours, he must engage in some of these activities in school. The school today not only makes the child the center around which the curriculum is planned, but this curriculum is made up of many of the activities in which the child will engage in life. The best growth of the child into a wholesome personality, in order that he may take his useful place in the world, rather than the child's unassimilated and unapplied knowledge of mere subject matter—this is the true criterion of the success of both teacher and pupil.

**Is the term activity well-chosen?** We may have been confused in the past by terms describing this program. In this chapter we have chosen the term *activity* for no particular reason other than that the type of education we want for children must be of the active variety and not a passive procedure. Activity seems to be the most important factor, but not alone in the child's development, also in the development of all human life there must be an environment of activity. However, the term activity is used as synonymous with unit of work, center of interest, enterprise, project, and other designations. It makes but little difference what we call the experiences, so long as we have in mind effective and satisfactory living and learning situations of a truly vitalizing nature. Living with children on the playground is indeed an activity if it is a genuine, significant experience. The activity curriculum is not a cut and dried plan that can be brought into the schoolroom in the form of a course of study, the activities must grow naturally out of the children's needs, their environment, and their interests.

**Are there various kinds of activities?** So far we have thought of the type of activity growing out of the schoolroom situation in which boys and girls learn to live together There will be certain interests shared by all or possibly by a certain group, initiated either by the teacher or by the children These activities may include perhaps only a very small portion of any one day's work and may be continued over a long period of time For example, in the first grade the framework of a calendar is made on the first day of school Each day a different child is selected to write the day of the month in its proper square On the wall of another school there is a frieze which covers practically the entire side of the room As a result of their study of Egypt, the third and fourth grades contribute ideas and create this painting The fifth and sixth grades cover the bulletin board with an exhibit of clippings and materials concerning Byrd's trip to Little America The entire school becomes interested in the germination of seeds as a result of garden planting The teacher selects the bean seed for special study because it grows quickly and is interesting to watch The third-grade children place several glasses of water on the window sill In each glass they first place cotton and on top of it a bean seed. The children then watch the beans sprout and eventually send their roots down and their leaves up Once in a while they take a seed out of the glass so that they can examine the roots and leaves in detail The fifth grade, interested in the cause of the seasons, make observations on the path of the sun. They record the position of the shadow of the window sill on a day near the end of September, then observations are made every two or three weeks with dates and positions recorded by means of brass tacks on the floor At the end of the year the record made on the floor furnishes an excellent means of studying how the sun approaches the horizon up to the twenty-first of December and then rises as spring and summer advance.

**Major activities.** Another type of activity which many teachers term a major activity is observed in many schools today. The modern school is dividing its subject matter more

and more into definite units of thought or activities. The year is being broken up into the best things to do. In the traditional school, every day's work was completely separated from every other day's work, the subject matter was apportioned to children and given to them in small doses, but with little thought as to whether it was assimilated properly or not. The schools of today no longer consider each day's work as a separate unit. Units of thought continuing over a period of a week or a month or even longer are now characteristic of our treatment of subject matter. In this type of activity an attempt is made to integrate the curriculum subjects. For example, the intermediate group becomes interested in a discussion of trees; a study of trees in their community and in other communities results. The children's interest in this activity lasts for many weeks and much of the children's work in English, geography, agriculture, arithmetic, and reading is correlated in this way.

The third and fourth grades become interested in Indians, at the free hour, time is used for activities relating to a study of Indian life. Each subject is taken up when it is most needed in this unit of work. Much of the reading, English, music, study of poetry, art, and health activities are taken care of in a more effective way than by the old question-answer and other traditional procedures. A puppet show as a first- and second-grade major activity is one that proves profitable from the standpoint of both pleasure and information. Reading, language, numbers, art, writing, and music experiences are an outgrowth of this activity and the children find much needed information. Other grades become interested with the result that a worthy enterprise for the whole school develops. The children of the particular rural school who are pictured in this chapter became interested in libraries, books, and especially in a library for their own room. The alcove had been used as a place in which to store unused textbooks and supplies. The children made the library table and chairs and took great pride in shelving interesting books which they bought, brought from home, or borrowed from the County Superintendent, the Traveling Library, or

other sources Besides developing a love for books, much information was gained

*Courtesy of Professor Richmond and Miss Knoell*

**Art work in a rural school**

Kalsomine is here used as the medium of expression

**Can the activity program be used in a rural school?** Certainly any situation that makes learning more effective must not be denied our rural children We want normal life experiences in our rural schools as certainly as we want them for our urban children. The rural school, as well as any elementary school, can be a place where children pursue their own interests and develop new interests To stimulate the interests of the child, to discover and satisfy his nature and needs, to help him make better adjustments to his environment—these are problems that need as serious consideration for the rural child as for the city child. The activity program takes care of between-recitation activities, which is perhaps the greatest problem of the rural teacher. Instead of sitting with his face behind his geography, supposedly studying his lesson but thinking instead of mischievous tricks to play when the teacher's back is turned, the child has an in-

teresting problem of his own to solve He is immersed in his work, in making plans, and in carrying them out The school day is often not long enough to do all the things he really desires to do Another argument for the activity program is that it takes care of individual differences. In the mixed group of the rural school an activity will have different appeals to different children; those of varying age levels will be able to make contributions that will cause the learning situation to be much more valuable for all If children of only one age and grade level take part, the learnings are neither so rich nor so varied

**Providing for all learnings.** Can all learnings set forth in the course of study be taught through activities? To this question an emphatic *no* is the answer Arithmetic, for example, is a subject requiring much individual drill, it is impossible to get all of this drill through activities An activity usually involves only a few necessary facts in arithmetic However, many opportunities are offered for the application of arithmetic, but the activities should not be made over to bring in arithmetic nor depended on as the chief source of problems or of drill Wherever they naturally involve arithmetic the opportunity to make such application should be utilized, but individual drill must be provided for, in any event Likewise, no program in composition, spelling, writing, geography, or history can live by activities alone McKee has illustrated this statement forcefully in his *Language in the Elementary School* (p 169) He says:

> A wise football coach usually isolates certain abilities such as blocking, tackling, and falling on the ball from the situations in which they normally occur, and provides specific practice upon these skills as things to be learned in themselves He does this because he believes that trying to get these abilities taught through football games won't get results Likewise, the careful violinist isolates such specific items as double stops, harmonics, and the vibrato for purposes of specific and direct practice. Later these skills are correctly applied in their normal environment.

**Need for special drill techniques.** When this program has been introduced teachers have found their children so enthusi-

astic about school, its environment, and its activities, that they do not mind some of the drill on techniques that becomes necessary. Much of the English, reading, art, and music can be an outgrowth of a major activity; but until our courses of study are revised, possibly around the unit plan, or until we decide just what bits of curricula are best for the children, it does not seem possible that any activity can incorporate all of the course of study learnings expected of children during a certain length of time. A considerable portion of the work in the classroom may center about the "major activity", yet other learning situations which are unrelated to the major activity may develop simultaneously and should be given attention. Many times, as the result of an activity, children may be led to see the need for drill. The actual *use* of a skill should be considered as important as the *acquiring* of the skill itself. Many teachers who provide a rich activity experience for children, set aside a few weeks at the end of the term for drill on the course of study requirements, which have not been met in connection with the activity. Every teacher is required to follow her course of study, but many times the children and teacher may together work out enterprises which will further the mastery of the prescribed work.

**How may the activity program be initiated by the rural teacher?** First of all, the rural teacher must be convinced that this is the type of program that most nearly fits her philosophy of education. She must become aware of the possibilities of this program. The old idea of subjecting the child to subject-matter routine must be subordinated to the ideal of meeting children's needs. School is life and the aim of life is achievement and satisfaction through right living. Then she must be sure that the county superintendent, school board, and patrons are in favor of the program. She must convince them that they can depend upon her to see that certain achievements and attainments set forth in the course of study are to be made, though she has changed her way of teaching. The next step is to study and respect the children—their ideas, interests, intelligence, abilities, individualities, and needs, then to study the environment, noting

the centers of interest and what factors, physical and social, are influencing the lives of her children There are some aspects of the environment which may provide more valuable and interesting learning situations than others There are some that may fit in better than others with her course of study and make the achievement of fundamental learnings easier Next, the teacher must be aware of the facilities at her command to carry on an activity There must be space; there must be reading materials, art materials, and construction materials Many an activity has failed because needed materials were not at hand, although the interest of the children was keen This does not mean that a large sum of money need be spent on these materials, old materials, left over materials, and odds and ends, as long as they are durable, collected by children and teacher, may be utilized with as good results as when all materials are purchased at a school-supply house Sometimes it is well for the children to find materials for themselves, but usually it is necessary to make much of it easily accessible to the children

**Other useful expedients.** However, one of our present problems in the rural school is the lack of reading materials to inform our children Teachers have met this problem in various ways by asking help from their county superintendent who usually has a library of children's books, by encouraging the children to bring books from home; by utilizing records written by other children about the subject; or, by encouraging children to write their own material to be passed on to others This latter plan provides one of the best ways of motivating written composition Many teachers have started the program by allowing the children one free period a week to work on the activity, possibly the Friday afternoon period The children become so interested that they want more free periods This leads possibly to a period a day and so on until the school becomes an active laboratory No sensible teacher who is in a formal school environment should expect to revolutionize the situation overnight She will work gradually into this program, making sure that all concerned with her school favor it. It may be advisable to introduce the

activity as an extra piece of work which does not replace any regular work All classes or groups, except the one developing the activity, continue with their regular work. It should be made clear to the children that this is extra work and that their regular work is going on as usual. Usually the keen interest in this extra work causes the children to want to do some of their regular work in the same way; so certain history work, for example, becomes a unit or activity instead of the next lesson in the textbook.

**Management of groups.** If the children have had little experience in working in groups, they should be helped considerably One group may be taken at a time, the others working on individual projects at their seats, until this group can take care of itself. Then a second group, a third group, and so on, may be supervised, until the activity period can be conducted with several groups working Usually each group has a chairman. He is the official representative of the group and is responsible for seeing that each member does his share of the work, that the work goes on smoothly, and that a report is made at the check-up period Groups work on some constructive activity, read to solve problems, work at notebook material, draw, collect pictures, or carry on some individual project related to a class problem. There are intellectual activities as well as physical activities Some teachers think that an activity must make great use of industrial arts or provide an exhibit of some kind before it can be called an activity, but this is not true.

**Need for good work habits.** Teachers have found that some rules regarding good work habits should be made Standards should frequently be set up by the children and the teacher for good working habits; the children should strive to establish these desirable habits. Here are some reasonable regulations:

1. Work as quietly as possible. It is not fair to disturb others who may be working on a class problem
2. Each person should accomplish something during the period.
3. Keep working on the task until it is finished
4. Share materials

5. Be a good follower as well as a good leader
6. Help others
7. Put everything away when finished and clean up the room

The period of discussion and selection of the activity is highly socializing and valuable Let the children work out the details and plan for the enterprise, be it constructing, dramatizing, problem solving, or what The teacher is an important member of the group, guiding, suggesting, and helping whenever she is needed. She is the best informed member of the group She is needed to draw out the slower children and to help all the children co-ordinate their efforts There should always be a check-up period at which time the children report their progress. Usually the chairman or leader of the group gives the report and suggestions are made as to whether this group accomplished enough and worked according to the standards. Frequently the standards are raised

**Does the activity program make for bad discipline?** This depends on what is meant by discipline If it means law and order of the pin-drop variety, where every move of the children is either dictated or sanctioned by the teacher, perhaps the activity program has no place in a school so ordered But if we think of discipline as meaning mutual good will in an orderly situation, the highest type of self-control, respect for others, self-direction, and responsibility—then the activity program certainly does promote such objectives We want freedom in our schools, but freedom with responsibility Someone has said: "Interest is the keynote of discipline" By use of the activity program, schoolwork ceases to be a monotonous, boring grind, and becomes instead interesting laboratory learning experiences. Working in groups is one of the finest ways to develop character. Self-control, responsibility, initiative, unselfishness, co-operation, individuality, respect for the rights of others, sharing, leadership, and followship are a few of the personality traits that may be expected from right guidance through activities

**Standards for evaluating activities.** After the teacher has studied the children and the environment and possibly a unit of

work has been suggested, she should carefully evaluate the potentialities which the enterprise holds for the group of children concerned It may be just one or two grades that are interested at first, but later all the children in the school may become concerned There are a number of criteria to help her decide whether or not a certain unit is worth the children's time

1. *Teachers' Guide to Child Development, Manual for Kindergarten and Primary Teachers* [1]
   - a Is the activity closely related to the child's life so as to lead him to want to carry it through?
   - b Is it sufficiently within the range of accomplishment of the learner to insure a satisfactory degree of success?
   - c. Is it so varied from the previous activity as to permit the child's all-round development?
   - d Does it furnish opportunities for many kinds of endeavor?
   - e Does the subject matter involved present major fields of human achievement?
   - f Does the activity involve an expansion of present insight and abilities?
   - g Does it provide an opportunity for social contacts?
   - h Will it lead into other profitable activities?

2. From *Organization of Curriculum for One Teacher Schools*, Department of Rural Education, National Education Association
   - a Does the proposed unit grow out of some genuine situation and include a purpose or purposes for its accomplishment?
   - b Does the proposed unit contribute to the general educational objectives?
   - c Does the proposed unit appear to afford a wide variety of activity in the children's school, home, and community environment?
   - d Is the unit sufficiently adapted to the ability range of the children and the school's limitation of books and equipment to promise success and stimulate growth in its accomplishment?
   - e. Is the proposed unit likely to afford learnings not adequately provided in the out-of-school life or not already experienced in the previous school life of the children?
   - f Does the proposed unit seem likely to afford experiences, stimulate interests, and arouse questions which will carry the children into other profitable units of work?

[1] Compiled by California State Curriculum Commission Sacramento State Department of Education, 1930

3. From *Curriculum Making in an Elementary School*, by the staff of Lincoln School, Teachers College, Columbia University.

   *a* The unit of work must be selected from real life situations and must be considered worth while by the child, because he feels that he has helped select it and because he finds in it many opportunities to satisfy his needs
   *b.* The unit of work must afford many opportunities for real purposing and real projects, and it will be something which the child can carry into his normal activity.
   *c.* The unit of work must stimulate many kinds of activities and so provide for individual differences
   *d* (1) The unit of work must make individual growth possible. (2) The succession of units of work must provide for continuous group growth from one level to the next.
   *e.* Each unit of work must furnish leads into other related units of work and must stimulate in the child the desire for a continued widening of his interests and understanding.
   *f.* Each unit of work must help meet the demands of society and must help clarify social meanings
   *g.* Each unit of work must be accompanied by progress in the use of such tool subjects as contribute to that unit
   *h.* Each unit of work must lead to the development of desirable habits

## A Major Unit on Trees

This activity unit on Trees was prepared by Miss Laura Knoell of the Bellevue School, Dodge County, Nebraska. Miss Knoell made use of this material in her own school, particularly in grades five to eight, inclusive; but she states that every child in the school was interested, and that the activity lasted almost an entire school year. This outline of activities is largely suggestive and should not be used by any teacher without adaptation to individual conditions and needs. Neither Miss Richmond nor Miss Knoell would expect any prepared unit, no matter how well done, to be handed over to all teachers as an enterprise which could be carried out equally well in all situations In a study of trees Nebraska is an especially favorable state and no doubt Dodge County is a particularly favored county for such an enterprise. In other states and communities

other units may be, and often are, found more desirable There are many units of a general nature, such as food, health, Indian life, and colonial life, which may be used to advantage in almost any school; other units, such as milk and dairy products, fruit growing, cotton, corn, grain, and manufacturing may have certain local aspects and values which make them especially useful as material for activity units

**A. Evaluation of unit of work**

1. Nebraska was the home of J. Sterling Morton, founder of Arbor Day, whose former estate is not far from our school Nebraska has contributed as no other state to Arbor Day and tree planting. We wanted children to feel the importance of their state and of its contribution to the world

2 Nearly everyone in this state is probably interested in trees. The intense heat in summer necessitates trees for shade and the intense cold in winter calls for trees as windbreaks and shelter In this environment the children have grown up with a natural interest in trees. Thousands of trees are planted here every year, and there is a widespread feeling of appreciation for them

3. Nebraska is a state with many beautiful trees The great number of trees in this particular locality, due to historical tree claims, provides a basis for historical study.

4. Nebraska is not considered a manufacturing state and does not provide numerous industrial situations that other states furnish and which serve as significant leads to other phases of life. It is an agricultural state, so we must use that as a lead to the study of other fields. The study of trees opened many new regions of interest for the pupils.

5. Previous training had been mostly through textbooks and the traditional type of program, so that an activity of this sort was helpful and enjoyable

6 The unit involved many different phases of study which made allowance for individual differences Children not interested in mental skills chose manual activity work with wood Others were more interested in intellectual aspects of the unit

7. Different species of trees do not grow naturally in Nebraska. It was interesting to study the trees that do not grow here as well as those which do, and why.

8. It has provided many social contacts with outside people in other parts of the country and with each other. Talks with pioneers who took tree claims, getting samples of trees in other localities, etc., have furnished social opportunities.

9. Trees were studied in connection with history (tree claims and historical trees under which Indians signed important treaties, trees which served as guides to pioneers on their way west, etc ), geography (trees in relation to climate and rainfall), and reading, spelling, writing, vocabulary building, cooking, and arithmetic.

**B. How the enterprise originated**

1. It was a yearly custom for the teacher to take her children nutting the first month of school This experience led to further study of trees.

2. The teacher pointed out various peculiarities of trees Children started to name the trees that they knew Some trees they did not know, so they decided to take home the leaves and a piece of the bark and ask the father of one of the pupils, who knew a great deal about trees, to tell them what kind they were and something about them. This led to the study of many other trees

3 The next natural step was a visit to the lumber yard This trip resulted in a study of forests and of various kinds of trees

4. Through study of regions and climates in connection with geography, the children became interested in studying trees in different countries and the influence of location.

**C. Other approaches that might have been used**

1 On Arbor Day a trip was taken to the former home of J Sterling Morton, the founder of Arbor Day. We visited this beautiful home, park, and museum.

2 We visited the large grove a very short distance from the school house There were many different kinds of trees, here was definite possibility of starting an interesting study of trees

3. Children brought in branches, leaves, nuts, or some product of trees which interested the group in further study

4 In connection with constructive activities which made it necessary to use various kinds of wood, children were curious as to the source of the wood

5 As a result of pictures brought to school (California redwoods, palms, or other trees seen on vacation trips) discussions developed as to why these trees do not grow here.

6 Discussions in nature study of birds, squirrels, chipmunks, and other animals who build their homes in trees.

7. Curiosity concerning the various woods of which schoolroom furniture is made.

8. Story entitled, "The Discontented Pine Tree" was read by the children.

9 A visit to a noted horticulturist in a near-by city who specializes in odd varieties of trees and in the grafting of them.

D **Activities in keeping with children's interests**· 1. Collecting leaves, buds, blossoms, twigs, and fruit of each tree for an exhibit sent to another school. 2 Collecting samples of various kinds of woods used in constructive activity 3. Collecting pictures of lumber regions of the United States 4 Collecting seeds of various trees, noting likenesses and differences, later putting these into a book Collecting leaves for a booklet. 5. Collecting nuts of various trees. 6. Drawing trees of different shapes to be put into a booklet 7 Making a cover design of trees to be used for a book 8 Making books of collections and illustrations and written descriptions of them 9 Writing a story to accompany an exhibit for another school 10 Writing stories on what they learned about trees 11. Listing uses of trees. 12 Observing the buds which open in the spring 13 Illustrating a lumber scene in the sand table. 14. Organizing a Nature Club A badge given to anyone for any valuable contribution to the group concerning trees 15 Study of other manufactured products of trees—paper, lumber, honey, silk, lead pencils Making a collection of these products. 16 Grab bag game—box containing various questions concerning trees Each child drew a question and was held responsible for answering This involved making reports to the group 17 Gathering nuts for winter use 18 Planting a tree in the school yard on Arbor Day 19. Taking kodak pictures of beautiful and exceptional trees. Making an exhibit. 20 Reading, writing, composing stories about trees 21. Collecting poems about trees 22 Learning the poem, "Trees," by Joyce Kilmer 23 Starting an apple tree from seed and grafting it (This takes longer than one year) 24 Reports from various children about trees Material read at home or in the city library. 25. Keeping a record of experiences in study of trees 26. Collection of various products of trees from all over the world 27 Observing tree being sawed down and noting rings which indicate age. 28 Organizing a club 29 Making jelly from fruit gathered in orchards.

**E. Children's questions:** 1 What is a forest? 2 How is lumber made? 3 How do trees get moisture? 4 Do all trees have flowers? 5. Does rain affect buds? 6 How do buds open? 7 How can you tell how old a tree is? 8. What kinds of trees have red buds? 9. How do bees get honey from tree blossoms? 10. How are canoes made? 11 Why is it that eucalyptus and pepper trees do not grow in Nebraska? 12 How do eucalyptus trees grow? (*a*) Fast or slow? (*b*) From seed? How is the seed planted, cared for, transplanted? (*c*) What are the uses? 13. How do pines grow? (*a*) Fast or slow? (*b*) From seed? (*c*) How is the seed scattered by nature? (*d*) What is their use? 14. How do peppers grow? How is the seed scattered? What is their

use? 15 Why do we not have more oak trees in Nebraska? 16. What trees would be best to plant in our school yard? What trees resist the dry hot summers and withstand the cold winters? 17. Why are Chinese elms suggested as good trees for our school yard? 18 What trees would make a good windbreak on the north side of our school yard? 19 Why do trees grow tall? 20 The cherry tree has white flowers and red cherries, if the flowers were red, would the cherries be white? 21 Where do palm trees grow? 22. What takes the place of leaves on the pine tree? 23 How did trees first get to Nebraska? 24. Why do so many trees grow along river banks? Did someone plant them? 25 What was a tree claim? 26. Why is grafting necessary for fruit trees? 27. How can the Joshua tree grow in the desert? 28 Where did Christmas trees originate? 29 Why do people tap maple trees in spring instead of fall? 30. Why did J Sterling Morton think Arbor Day a good idea? 31. Where is the oldest tree in Nebraska? 32. Why can't cotton be made from cottonwood trees? 33 From what kind of trees are telephone poles made? 34 Why do not all people make their houses of wood? 35 What kind of trees grow in the North? 36 What is a jungle? 37 How can trees grow on mountains? 38 What is the timber line? 39 What kind of trees would be best for our school ground? 40 How does lumber get to us? 41 Do trees grow in China? What kind?

**F. Excursions:** 1 Children and teacher went on their annual fall nutting trip 2 Children visited a sawmill in connection with study of local industry 3 Children took a trip to see a pine tree. 4. A tramp to identify as many trees as possible. 5 A field trip to a wooded section which resulted in making a collection of bright leaves, twigs, nuts, and fruit 6 Excursions to the home of the noted J Sterling Morton; his park, museum, and beautiful home 7 Excursions to parks and residential districts for general observation of trees, to one residence in particular which has over 800 different varieties of trees and shrubs. 8 Excursion to historic tree claim to collect samples, identify the trees, and develop some appreciation of them 9 Visit to the dam and old sawmill 10. Visit to Plumfield Nursery 11 Visit to the home of the famous tree grafter near Ulysses, Nebraska, and noting the results of his grafting. 12. Excursion to home of Mr. M.——, a pioneer, who makes hand-carved furniture. Observed the unique table made of 1048 different pieces of wood 13. Excursion to the nursery to observe the different kinds of trees and to select a tree for the school yard 14. Visit to the home of an old pioneer who obtained his land through a tree claim. 15 Trips to various different kinds of trees chosen by the class for observation.

**G. Experiments:** 1. A piece of cheesecloth was tied over a glass jar partly filled with water Cloth was pressed lower in the middle so that it was kept moist but not flooded Seeds were sprinkled on the cloth and glass jar was set in bright sunshine Seeds were watched as they sprouted Coloring matter was put into the water and watched as it went up the stem. This showed the importance of roots to the plant. 2 Observed the effect of the sun on leaves. The leaves of the plants turn toward the sun. Why? 3. Observed how the plants take up moisture Flowers in vase of water Water is soon gone. Why? 4 Observed the effect of light on leaves Plants put in the dark soon turn yellow. Why? 5 Experiment in grafting trees 6. Observed how trees get moisture through their roots. 7 Observed how trees react to various kinds of soil. 8 Planted some seeds in clay, in sand, in loam, noted differences Why are there differences? 9 Experiments with fungus plants. Note especially those which are enemies of trees. 10. Experiments to note the necessity of bark on trees. Cut a narrow ring around the tree. The tree died. Why?

**H. Use of State Museum:** 1 A forestry collection was received from the State Museum. 2 Teacher visited Museum in connection with study of wood. 3 Trip to Museum to learn how Indians used trees: canoes, bows and arrows, looms, tepees, etc 4 Trip to note curios made from trees, such as redwood bolls, palm leaf fans, etc. 5. Trip to note colonial and antique furniture, different kinds of wood used, to determine why so durable 6 At the Museum note pieces of petrified forest. 7 Trip to note ancient use of wood for printing and wood carving 8. Trip to observe wood from other countries. Note the influence trees have on people, or on their homes, furniture, etc. 9. Trips to note various uses of wood. 10. Collection of antique furniture for the school museum.

**I. Use of pictures, films, stereopticons, etc.:** 1. Use of pictures in the study of paper. 2 Use of pictures in the study of the lumber industry. 3. Pictures of various kinds of trees in other countries 4. Collecting pictures of lumber regions. 5. Study of masterpieces of painting "Spring"; "Dance of Nymphs", "Harp of the Winds", "Avenue of Trees"; others. 6 Collection of pictures of various kinds of trees in all parts of the country to put in children's books. 7. Use of pictures from nursery catalogues (These are not very useful for tree study, however) 8. Films available from the Bureau of Visual Instruction, New York City

**J. Books that helped us:** Teacher and children used practically the same books. They borrowed many of them from the Fremont City

Library and Midland College Library, Fremont, Nebraska, from the State Traveling Library, and from the County Superintendent.

1 Apgar—*Trees of the Northern United States,* American Book. 1928
2 Bailey—*Standard Encyclopedia of Horticulture,* Macmillan 1914
3 Berry—*Western Forest Trees;* World Book 1924
4 Comstock—*Handbook of Nature Study,* Comstock. 1929
5 Curtis—*A Guide to Trees,* Greenberg 1925
6 Curtis—*Stories in Trees;* Lyons and Carnahan 1925
7. Elson-Kelly—*Child Library Readers, III,* Scott, Foresman. 1929
8. *Encyclopedia Americana*
9 *Encyclopedia Britannica*
10 Forestry Society of U. S —*Bulletin No 5,* U S Dept of Agriculture
11. Free and Treadwell—*Readers,* Book II, Row, Peterson. 1920. "The Fir Tree", "The Discontented Pine Tree"
12. Going—*Our Field and Forest Trees,* McClurg 1928
13. Holbrook—*The Book of Nature Myths,* Houghton 1902. "Why the Evergreen Trees Never Lose Their Leaves" and "Why the Juniper Tree Has Berries"
14. Keeler—*Our Native Trees and How to Identify Them,* Scribner. 1900
15 Lewis and Rowland—*Facts and Fancies,* Book IV, Winston 1930. "The Pine Tree"
16 Lewis and Rowland—*Whys and Wherefors,* Book V, Winston. 1930 "The Wonderland of Redwood Trees"
17 Mathews—*Familiar Trees and Their Leaves,* Appleton 1923
18 McFarland—*Getting Acquainted with Trees;* Macmillan 1924
19. McFee—*The Tree Book,* Stokes. 1919
20. Moon—*The Book of Forestry,* Appleton-Century 1927
21. Mosely—*Trees, Stars, Birds,* World Book 1924
22. Pack—*School Book of Forestry,* American Tree Association 1922
23. Pack—*The Forestry Primer,* American Tree Association 1926
24 Pack—*Trees as Good Citizens,* American Tree Association 1922
25. Pack, Lathrop, and Gill—*Forest Facts for Schools,* Macmillan 1921
26. Pearson-Hunt—*Everyday Reading,* Book I, American Book. 1927 "Why We Love Our Trees"
27. Pinchot—*A Primer of Forestry;* U S Dept. of Agriculture 1928
28. Pinchot—*Use of National Forests;* U S Dept. of Agriculture. 1928
29. Rogers—*Tree Guide,* Doubleday. 1931
30. Rogers—*Trees Every Child Should Know,* Grosset and Dunlap 1909
31 *Scientific American,* Vol. 115, July to December, 1916, Munn
32. Stokes—*Ten Common Trees,* American Tree Association 1926

**K. People who helped with the activity:** 1. Father of one child visited our school and answered questions. 2. Department of Agri-

culture furnished information. 3. Mr A, Ulysses, Nebraska, a specialist in grafting, tree planting, etc 4 Caretaker at the J Sterling Morton home. 5 Mr C, owner of lumber yard, told children about the lumber industry and how lumber gets to us 6 Mr K, who has a collection of various kinds of wood in his museum and is one of our pioneer citizens. 7. Mr. M., who has a hobby of making furniture of small pieces of various kinds of wood. 8 Owner of log cabin who has a collection of antique furniture 9. Information from owner of sawmill on how lumber is made. 10 Information from nurseryman about growing trees and caring for them 11. Information from County Agricultural Agent on how to care for trees, the most valuable trees to plant in the school yard; how to get more information about trees 12 Talks with pioneers about how trees helped them 13 Information from owner of large orchard about fruit trees, enemies of trees, care of trees.

**L. Construction possibilities:** 1 Made charts of trees and birds. 2 Planted nuts in boxes 3 Made bluepints of leaves 4. Put collections in books 5 Beautified school yard by planting trees and caring for them 6 Constructed toys, doll furniture, animals 7 Constructed school furniture; tables for exhibits 8 Constructed birdhouses. 9 Constructed gifts for parents and friends, such as bookends, tables, etc 10 Made sawmill and illustrated a lumber camp on floor and out-of-doors 11 Waxed or shellacked leaves to make more permanent 12 Started trees in boxes by use of seeds. 13 Simple wood carving. 14 Stick printing 15. Made picture frames and mounted pictures 16 Children became interested in entire telephone system after learning about the poles

**M. Communications:** 1 Communications with nurserymen for pamphlets, booklets, etc, on trees 2 Communications with children of a New England school and a California school to exchange exhibits with them. 3 Writing to lumber companies for pamphlets and booklets 4 Writing to nurseries for pamphlets, booklets, and other materials on trees 5 Communications with County Agent, Department of Agriculture, and Agricultural College for information. 6 Communications with lumber companies for material on trees

**N. Play:** 1 Play in the leaves 2 Play in matching leaves 3. Puppet show to illustrate the story of life in a lumber camp 4 Dramatization for Arbor Day Program 5 Climbing trees 6 Making swings 7 Dramatizing stories read or told about trees. 8 Play with toys and articles constructed. 9. Entertainment or play for Arbor

Day Program to which parents were invited Tree Unit was explained to parents at that time

**O. School subjects and associated learnings:**

1 Reading Stories from readers, library books, books at home, pamphlets and booklets, reference books for answer to questions, *Instructor* and other magazines, and stories that teacher wrote and mimeographed

2. Writing Neat explanations to go with pictures in books, letters for information, and information to accompany exhibits

3 Arithmetic (*a*) construction of articles, measuring, estimating amount of lumber needed, figuring cost of lumber (*b*) buying trees for school ground, estimating, ordering (*c*) estimating heights of trees, circumferences, ages (*d*) making jelly from fruit gathered in orchards (recipe). (*e*) sale of jelly and articles made

4 History Origin of tree claims, use which pioneers made of trees, how trees were used by Indians, how certain trees helped gold seekers, people moving westward, and Indians to find their way, how trees were used as a way of getting land, how trees sheltered the first settlers in this country, historical trees of Nebraska and of United States, what oak and sycamore meant to ancient peoples, American trees which have had a place in history, such as the Charter Oak, William Penn Tree, etc

5 Geography How different lands and climates make growth of trees possible, from study of products to study of trees, industries that developed from use of trees, localities where trees grow, location of national forests, petrified forests, how trees have a connection with the geography of a country (for example, in China trees served to retain a certain amount of moisture, now they have been cut down and China has great floods every year), how climate and rainfall affect trees—jungle trees, Joshua trees in deserts, cottonwood trees in Nebraska, eucalyptus trees in California, etc. Why they grow in these places

6 Drawing Collecting and pasting pictures; drawing leaves, drawing, painting, and coloring trees; painting and sketching trees with special regard to shape, study of famous masterpieces of art which are pictures of beautiful trees, study of proportion, balance, and many other fundamentals of drawing and color as found in trees and in all nature, collecting drawings and pictures

7 Nature Study Names of trees in home locality and others, what trees give us, enemies of trees, how they harm and how destroy them, reforestation, study of birds and animals that use trees for their homes; study of peculiarities of certain trees, their leaves, shapes, bark, enemies,

etc., planting trees; industrial processes developed through the use of products of trees, study of forests and trees found in forests, ability to recognize the trees of Nebraska and to know interesting things about them.

8. Spelling Words needed to write letters, in making books, in writing stories, record books, poems, etc.

9 Language Oral reports, business letters, poetry—classics committed to memory and originals composed by class, reports of committees, conversations with people in securing information, making records of experiences.

10 Hygiene Food values of various kinds of nuts, values of fruits; healthful foods that we get from trees—maple sugar, for example, healthfulness of outdoor life.

11 Gardening. Planting trees in school yard for decorative purposes and as windbreaks.

12 Knowledge—habits—attitudes—appreciations· Knowledge of trees, characteristics, growth, use, habits of co-operation, of organization of work with classmates, habits of control and unselfishness, skill in sewing, gluing, preserving leaves, cutting, writing, composing stories, letters, reading, speaking, interest in nature and increased wonder about her attractions, ability to distinguish trees, appreciation of beauty of trees, appreciation of uses of trees and their relation to human life, desire and ability to prepare something of value which involves study and work, favorable attitudes toward habits of study; beginning of habits of scientific investigation; development of ability to observe accurately

13 Music Songs in connection with trees, of trees when wind is blowing, sound of sawmill, song of woodcutter, making songs about trees, Joyce Kilmer's famous "Trees"

14 Citizenship Care of trees at home, on school ground, in community; care of forest lands, fire prevention measures and regulations.

15. Tests made and used by teacher· Completion tests, *yes-no* tests, blank-filling tests, direction tests; commercial standardized tests also used

## REFERENCES FOR THE TEACHER'S READING AND STUDY

1. CALIFORNIA STATE CURRICULUM—*Teacher's Guide to Child Development;* California State Printing Office 1930. $1 00
2. CLAUSER, L. W. & OTHERS—*Educative Experiences through Activity Units,* Lyons and Carnahan, 2500 Prairie Avenue, Chicago, Illinois. 1932 $1.80.

3. DEPARTMENT OF RURAL EDUCATION N. E A.—*Organization of Curriculum for One-Teacher Schools.* 1933. $ 25.
4. GUSTIN, M , and HAYES, M. L —*Activities in the Public School;* University of North Carolina, Box 510, Chapel Hill, N C 1934.
5. KNOX, ROSE—*School Activities and Equipment;* Houghton Mifflin Company. 1927.
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8. NATIONAL SOCIETY FOR THE STUDY OF EDUCATION—33d Yearbook, Part 2, *The Activity Movement,* Public School Publishing Company, 509–513 East St , Bloomington, Illinois 1934.

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1. *American Childhood*—Milton Bradley Company, Springfield, Massachusetts $2 00
2 *Childhood Education*—Association for Childhood Education, Washington, D. C $2 50
3 *Progressive Education*—Progressive Education Association. New York City. $3 00.

## CHAPTER XXI

## DIRECTING STUDY ACTIVITIES IN THE RURAL SCHOOL

**Meaning of study.** During the past quarter century, since Dr F. M McMurry's famous and classical book on study appeared, the term *study* has come to have a much wider and more definite meaning than formerly. It is now clearly understood that study implies vastly more than merely reading and memorizing the text Usually study has had reference to the acquisition of knowledge from the printed page, but teachers should also understand that study often involves objective activities of various kinds in which rocks, leaves, flowers, corn, and other things in the world itself are examined and studied Pupils may study through directed observation as in excursions or by consulting various people, such as a farmer, relative to the selection of seed corn, to secure their knowledge If one were to give a fairly comprehensive characterization of study, it would probably be correct to say that study is *thinking* The term *thinking* is used here in the general sense to mean much that is involved in the learning process, including various forms of imagery, the forming of the general notion, and reasoning, both inductive and deductive McMurry defines study as "the work that is necessary in the assimilation of ideas,"—"the vigorous application of the mind to a subject for the satisfaction of a felt need." Worth-while study includes the formulation of problems and the gathering of data for their solution Pupils often need to seek facts so as to be able to prove a proposition, and this is one element in study.

In genuine study pupils will be taught to challenge the value and worth of textbook statements and of the statements of members of the class and others Many times the class will need to arrange the statements of the text in the order of their im-

portance Making logical outlines to show such subordination of material is a useful form of study "To study is to apply the mind to books, arts, or any subject, for the purpose of acquiring knowledge, to study is to acquire knowledge by systematic investigation, reading, memorizing or the like, to fix the mind closely upon a subject for the purpose of acquiring knowledge " [1] Study, in its highest and best sense, consists in bringing the whole mind to bear upon the accomplishment of a distinct learning purpose through effort, attention, reason, and continued mental occupation or engrossment, when the purpose is in the nature of or involves a problem of immediate personal interest True study results in ideals, habits, interests, and abilities

**Significance of study.** It is practically impossible to overestimate the value of study to a pupil or the importance of forming right habits of study To be able to study effectively is an infinitely greater practical power in life than the ability to recite subject matter which has been mechanically memorized from a textbook In the average rural school the teacher is usually a hearer of book lessons If half the time now spent on the testing recitation could be used in supervised study, particularly during a study-recitation exercise, the pupils would profit greatly by the shift of emphasis If a pupil learns how genuinely to study while in the eight grades, he may readily become a life-long student; his subsequent career in high school and college is much more likely to be both pleasant and profitable On the other hand, many a child has taken a distaste for all knowledge and learning because his teacher did not appreciate the importance of study or know how to teach right methods of study A young person's mind often becomes so inundated with the ideas of other people, through books and from other sources, that he apparently loses the power of using his own ideas He thus becomes the victim of other people's ideas. If the art of study is properly taught, the pupil will learn to evalu-

[1] Reproduced by permission of the publishers of *Webster's New International Dictionary*, Second Edition Copyright, 1934, by G and C Merriam Company, Springfield, Mass

ate the ideas of others, to think independently for himself, to achieve his own ends.

**Objectives in study.** In study that is worthy of the name a variety of aims or goals may be set up for the guidance of teacher and pupils Sometimes the purpose is to solve a problem in reading, arithmetic, geography, history, or other subject. If a pupil finds a satisfactory and therefore rational answer to the question, "Why has Chicago grown to be one of the largest cities in the world?" he will surely need to study In answering the question he may need to use several different books Study often consists in attentive repetition to develop added skill or to help fix a habit John may drill himself on *7 plus 8* or on how to spell *privilege*. The teacher must prepare the child for the drill work by suitable preliminary teaching and by the necessary supervision while it is going on Study often consists in learning how to use a book to the best advantage—its table of contents, index, arrangement of topics, and appendices Such study is best as a group exercise under the teacher's direct supervision, although the child can also be taught to work by himself Sometimes profitable study may be the making of a list of references on a particular subject, using several books designated by the teacher Topics like cotton, corn, Lincoln, irrigation, Revolutionary War, and Declaration of Independence may be "run down" in the library with great profit. Again, study may take the form of memorization, providing this form of study has been preceded by painstaking teaching If there has been preliminary class work, pupils may memorize certain definitions, stanzas of poetry, and other material by themselves, though much of such memorization work is better as supervised group study.

Another objective may be set up when pupils are taught and trained to select the most important statements in the lesson and to tell why they are important. Such study involves writing in which the pupil prepares for a class discussion He will use his notes to make his contribution to a socialized conversation. It is often useful to have pupils pass judgment upon statements of the text or of any source material Did Lincoln do right, in

your judgment, when he issued the Emancipation Proclamation? What are your reasons for thinking as you do? Pupils will never develop power to judge unless they are practiced in giving judgments An aim, or objective, which should often be consciously realized is that of applying the knowledge learned Pupils in a rural school may be taught a great deal of usable subject matter, just how this may be used in life is a vital subject for consideration A great deal of study in every rural school should center around a carefully prepared list of problem questions in history, geography, reading, or nature In working out the answers to such questions, the child should be taught that the single textbook often needs to be supplemented Illustrations may be found in other sources and the child can be taught to study subjects, topics, and problems, not merely books

**Maintaining suitable conditions.** In many rural schools physical conditions for successful study are far from satisfactory. The room is frequently hot and stuffy, and lighting conditions are often unfavorable. The temperature should be kept between sixty-five and sixty-eight degrees Fahrenheit; the air should be changed frequently. If there is no ventilating system, the room should be thoroughly aired out every hour, especially if there are many pupils Single desks are greatly to be preferred, of course Pupils should be taught to get all their books and materials ready before they begin to study Pencils should be sharpened, and pen and ink should be at hand so that the study time will not be interrupted Many a country school pupil cannot study successfully because he is suffering from some physical handicap, such as defective eyesight, defective teeth, adenoids, or obstructed nasal passages. The pupil must be at ease physically, and external causes for disturbance and distraction should be reduced to the minimum. In other words, conditions favorable to the concentration of the mind should prevail Teacher and pupils should talk in low conversational tones The emotional tone of the school should be pleasing and gently stimulating; the general spirit of the school should be invigorating, not ir-

ritating or distracting. The emotional element is highly important in all study; it is the duty of the teacher to provide a proper emotional atmosphere

**Important study habits.** The study habits which a child forms in school will probably be of greater lifelong service to him than anything else the school can do for him. If he forms the very bad habit of accepting statements in a book or elsewhere in an unquestioning, uncritical attitude he may easily in adult life become the victim of various schemers and promoters who prey upon the unthinking, gullible public, upon people who are ignorant and who have not learned how to solve their own problems independently Among the important habits of study which a child should acquire are the habits of gathering *sufficient* data for the solution of his problem, of organizing the facts which have been secured so that they represent a definite, co-ordinated whole, of properly evaluating evidence so that its usefulness for the purpose in mind may be adequately fixed, of testing conclusions to see whether they are based upon sufficient evidence and whether they can be suitably verified by various methods of proof, of suspending judgment when the facts, data, or evidence in hand do not seem to be sufficient for making a deduction. A thoughtful teacher will be far more concerned to see that such valuable habits are formed, even if not so much subject matter is covered. It is a progressive day in a teacher's experience when she realizes that subject matter is in this regard only the means to an end. In study the subject matter comprises the learning materials with which teacher and pupils work It is to be used to realize educational objectives and not to be memorized without thought or question

**Problems motivate study.** Study cannot be discussed without some consideration of the problem idea, for study is thinking; the need for thinking arises when there is a problem requiring solution. Life is made up of problems, as has been pointed out in Chapter XVII, when anyone has a personal problem the solution of which is a vital matter for the individual, there is the natural setting for the highest type of motivated study. Study

carried forward under the stimulus of a personally interesting and significant problem is the most fruitful of all study. Whenever life presents new conditions which must be faced and reckoned with, the individual must depart from the beaten path of habitual action, and a new course of procedure must be mapped out. This requires thinking, the essential element in any study worthy of the name.

**Study in the rural school.** In the average rural school the work of study is usually neglected because the teacher does not know its importance or how to train pupils in good habits of study. Much of the pupil's time is wasted in gazing at the page, in listless, purposeless reading, or possibly in mischief. Some teachers tell even little first-grade children to go to their seats and study their lessons. When you think of it, what a ridiculous direction! How can small pupils study a reading lesson? What would such study be like? Small pupils cannot do successful individual work. Their study needs to be supervised, carefully directed group work with small children is the best solution of the problem. Usually the smaller pupils in a rural school should either have profitable, directed, individual, educational seatwork or group activities, or be out-of-doors playing. In the rural school the teacher need not and should not "hear recitations," one after the other, all day. She requires time between classes to supervise the work of individuals in all grades. It will often be time well spent, if teacher and pupils will work together in a group exercise, where study, rather than recitation, predominates. Supervised dictionary study is very profitable, teacher and pupils may well study the spelling lesson and other lessons together, also. Pupils in a rural school need much instruction and training in the art of mastering the printed page. Topics need to be broken up and study questions made out. Such work may profitably be done during a study-recitation. Altogether too much time is spent on testing, particularly through the use of the oral question-and-answer procedure, which is often a sheer waste of time and practically barren of educational results.

**Individual supervised study.** The rural teacher should understand that supervised study in her school may go on during a study recitation or it may be carried out between classes or recitations There should be both kinds of supervised study, the first largely a group activity, while the supervision as the teacher goes from desk to desk is mostly individual An up-to-date rural teacher will cut down her testing recitations, and do a great deal more of this supervised-study work than most teachers are doing at present.

It is well to keep in mind that when you are working with a pupil in his study activities, you are teaching him as truly as when you hear him recite his lesson—often much more so Pupils vary greatly in their need for help Some need just a hint, others require repeated and daily assistance in all the steps of their study and acquisition No child should be helped to the extent of robbing him of the power and the joy which comes through personal victory in overcoming difficulties. It is a fine art, learned only by practice, to know when to help and when to keep hands off in this supervised study. Many times the teacher's function is simply to show pupils where they can find the help they need, and then to leave them to work out the problem by themselves

It will be useful frequently to assist a pupil in formulating and stating his problem or questions, set him on the track of the solution, and then leave him to his own devices It happens many times that a child has difficulty because he does not read carefully, thoughtfully, adequately. By the use of a skillful question or two the teacher should stimulate the pupil to go over the paragraph or topic again to find the facts which he has failed to get before In all of this individual work with a pupil the teacher can easily train the child to make notes in good form, which is one of the important factors in successful study Here is opportunity for fruitful, well-motivated work in English A well-kept notebook in geography, history, and other subjects may certainly be an objective worth considerable time and thought

In the work with individual pupils at their seats a teacher will

be able to observe the study habits of each child If a pupil is wasting his time, the teacher should know why, there are various reasons, the chief of which are lack of adequate motivation and of sufficient knowledge and skill in the art of study A great deal of time is wasted because pupils have wasteful habits of work If the child is discouraged or finds study distasteful, the teacher should know it and find ways of overcoming the difficulties Find out if the child reads the lesson material over without attention to meanings or to implications and applications Find how he memorizes Inquire into his methods of attack, and teach him to go below the surface The rural teacher should spend many so-called group recitation periods in showing pupils just how to do their work Study skills vary greatly according to types of subject matter and also in relation to the maturity and advancement of the pupil Use whatever time is necessary to show pupils how to use dictionaries, encyclopedias, and other references

**Directed group activities.** Successful rural teachers are making increasing use of class periods for directed study activities They find that they can save a great deal of time in this way both for themselves and for their pupils; moreover, they have discovered that in this way pupils learn more and that better results are secured in the several varieties of testing procedures The general purpose of directed-study lessons is to do anything for pupils which will enable them to work profitably by themselves Often the teacher will actually go over the lesson with the class, all having books open, carefully taking entire periods for the purpose It may be that in this way a new learning unit may be presented so that the members of the class will get a connected bird's-eye view of the related parts, and so that enough subject matter will be opened up for several days of independent, individual study If study is well done, the testing procedures will move forward quickly and without much difficulty In this directed group activity the teacher should endeavor to bring out the difficulties of the whole class and the particular difficulties of individuals This type of class activity is not a recitation, it is a discussion and a planning exercise

during which objectives will be set up and very definite preparation made for the work of the pupils at their own seats Both teacher and pupils talk and both ask questions It will frequently be a good thing for the teacher to give an overview or a preview and possibly a pretest for diagnostic purposes Problems will be formulated, reference books listed, study questions assigned Pupils will go from such an exercise with a conviction that the new unit has important learning possibilities in it

**Study of things.** In geography, agriculture, nature study, physiology, and some other subjects, teacher and pupils will often find it best to get their knowledge at first hand For example, in the lesson on the formation of soils, it will not be difficult to have pupils bring in various kinds of rocks, such as sandstone, limestone, and granite, and to examine them to see how they differ In study of this kind the teacher may help matters greatly if she will direct it by calling attention to important characteristics through the use of study questions What is the color of each rock? Which seems to be hardest? Softest? Which do you think you could break up most easily? Of what is the sandstone made? If the limestone breaks up what sort of soil is made from it? How many kinds of elements can you see in the granite? Pupils may also bring to school various kinds of soil, such as sandy soil, clay soil, or rich black loam, for examination and study The study of things should be almost a daily affair in any live, up-to-date, rural school

**Analyze the lesson.** In order to illustrate the use and value of outlines and study questions, let us take a geography lesson for pupils in the fifth or sixth grade Many times these two grades are combined into one class in the rural school Many books give useful study questions, and the teacher should instruct pupils in the use of these questions Such instruction should be given during a study-recitation period The following outline and questions are based upon a lesson in a well-known first book in geography [1]

[1] From BRIGHAM AND MCFARLANE—*Essentials of Geography—First Book*, p 10, by arrangement with American Book Company, Publishers

The general subject of the lesson is "How Rocks Are Broken up to Form Soil"—The first sentence, a paragraph, gives the general theme "There are several ways in which rocks are broken up to form soil" Then these different ways are discussed as indicated in this list of topics

(1) Effect of heating and cooling
(2) Effect of water on sandstone
(3) Effect of water freezing in rocks
(4) Effect of growing roots
(5) Rock covered with soil
  (*a*) As seen in cellar or hill side
  (*b*) Variations of different layers
(6) Small stones moved by stream
  (*a*) Effect of rubbing together
  (*b*) Effect of a flood
  (*c*) Breaking up of stones
(7) Why stones are smooth and round
(8) Fine particles worn off
  (*a*) Carried away by streams
  (*b*) Deposited in still water

At the close of the discussion, which takes up about a page, there is a summary as follows "Soil is formed chiefly from broken rock Rocks may be broken by quick changes of temperature, by the dissolving of natural cement, by water freezing in them, by the growth of the roots of plants, and by the bumping together of stones in the moving water of streams"

One of the elements in study is the making of such summaries, and pupils should be practiced daily in this art of getting the meat out of the discussion

Study questions based upon the lesson, to be used by pupils in study at their seats, might be as follows (1) What is the general subject of the lesson? (2) Is this a good title? Name another one (3) What is the first way mentioned and where can you find a good illustration of it? (4) What happens when the cement is dissolved? What dissolves the cement? (5) What happens when water gets into rocks? (6) How can you show that rocks will take up water? (7) What is the effect of growing roots? Did you ever see a case of this kind? Where? (8) Have you seen

different layers of fine and coarse rock in a hill side? What does this prove? (9) How can moving stones make soil? (10) How can you show this? (11) Bring a round stone to school. What made it round? (12) Be able to give the summary when you come to class How many ways are mentioned?

**Use of workbooks.** We are now witnessing a veritable deluge of workbooks in every conceivable field of subject matter Some of these workbooks are highly educational in character, and some of them are evidently prepared rather carelessly with no particular educational principles or objectives in mind The rural teacher should unquestionably make use of workbooks because, for one reason, they are one useful means of solving the problem of individual study However, every teacher should consider whether a particular workbook fits in with the state course and whether pupils will be able to use it with success and profit A good workbook is well organized and carefully graded It is adapted to the age and grade for which it is intended It is prepared in such a way that the children will get valuable knowledge, skills, and attitudes in using it It provides adequate, clear, definite, concise directions, and furnishes the proper blank spaces for well-considered answers It is decidedly not a device for merely giving children something to take up their time, like the old so-called "busy work" It must be scientifically correct, educationally sound, and up-to-date The good workbook furnishes means for the pupil to test his accuracy and his progress; instructions for making graphs of individual achievements are often given Teachers must thoroughly realize that all workbook study must be carefully directed and checked If workbooks are intelligently and wisely used, they are of great help to rural teachers

**Memorization as a by-product of thinking.** Which is worth more—to have a girl memorize "October's Bright Blue Weather" (often in a more or less mechanical fashion) or to have her understand it and appreciate the beauty of it? There is only one answer to the question Should not memorization be a by-product of the thinking and appreciation, at least for the

most part? If the child has clear, definite images of the goldenrod, the fringed gentian which closes up its blue eyes at night, the brook, the bumblebee, and all the rest, and if there is appreciative reading on the teacher's part, together with both conscious and unconscious imitation on the part of the child, will not the poet's message get into the heart and the life of the child more certainly than through a mere memorization of words? Furthermore, how much time has a teacher for testing pupils in a class exercise as to whether they can repeat the words of a poem or not? Wouldn't it be much better to use the class period for an appreciation lesson, then do the testing in some incidental way, perhaps outside of the class period and by writing, at least in part? Unquestionably children should store in mind many beautiful poetic selections In the case of the poem mentioned one beautiful stanza, perhaps selected by the pupil himself and learned with genuine appreciation, would mean much more to him in after years than the formal, routine memorizing of all the words Study poetry *with* the pupils much more, and strive to reduce unthinking memorization of mere words to the zero point whenever possible

**A directed-study class exercise.** The particular subject in the agriculture class which seemed to be causing difficulty was *Weeds* [1] It was perhaps not so much a difficulty in understanding the statements of the text, for they were quite clear and definite The problem was mainly one of organization and presentation The teacher had been asking scrappy questions in miscellaneous order, and the pupils in the class had responded in fragments of statements So this teacher, who had recently been to a meeting where the study-recitation was discussed, and who had also been reading up on the subject, resolved to stop the testing recitation procedure and to *study weeds with the children and with the books open*

The lesson came in the month of September, the six members of the *A* class—Mary, Jane, Alice, George, Henry, and John—had brought

[1] UPHAM, A A., AND SCHMIDT, G A —*An Introduction to Agriculture*, D Appleton-Century Company, New York.

to school various weeds, including ragweed, quack grass, Canada thistle, burdock, wild parsnip, plantain, yellow dock, purslane, and prickly lettuce These weeds were in sight and available for study, along with the book. There were six topics in the text, the teacher asked John to name the different topics, which he did They were as follows What a Weed Is—Why Weeds Are Enemies—Classes of Weeds—Annuals, and How to Kill Them—Biennials, and How to Kill Them—Perennials, and How to Kill Them John was asked if he could think of any other topic which should be discussed under the head of weeds He was unable to name another

"Mary, what is the definition of a weed?" Mary reads—"A weed is a plant growing where it is not wanted" "Do you think that is a good definition? Why? Are all weeds on your farm also weeds everywhere else? Illustrate."

"Alice, in the topic, 'Why Weeds Are Enemies,' how many different reasons are given?" Alice reads silently and intently and says that she finds five reasons given She names these five reasons "What else, Alice, is given in this paragraph besides the five reasons?" Alice looks carefully and states that she finds a quotation relative to the unsightliness and disgrace of weeds "From what is this quotation taken?" Alice does not know nor do any of the others. See if you can find out by tomorrow. Alice tells her teacher in the morning that the quoted sentence is from the Bible, her mother had told her and she locates and gives the statement

"Henry, how many and what classes of weeds are named?" Henry looks at the book and answers correctly "Henry, what is the chief characteristic of annuals? Of biennials? Of perennials?" Henry looks sharply, and then the teacher has him tell the distinguishing attributes without looking in the book The teacher then suggests that Henry write the three definitions carefully on the board He makes some mistakes, which all take a hand in correcting The English is noted carefully, and the work is finally done neatly and in good form

Mary, Jane, and George contribute their share, and the last three topics are carefully analyzed so that the pupils understand and can separate the large points or heads. By use of the book the different members of the class note that of the specimens in the room there are three annuals. ragweed, purslane, and prickly lettuce There are two biennials burdock and wild parsnip The perennials are quack grass, yellow dock, plantain, and Canada thistle In all this work teacher and pupils co-operate in a socialized study-recitation The pupils have also been asking questions concerning the book statements and relative to the various specimens

As a result of the study of the text, teacher and pupils work out an

outline which the teacher places on the board with the help of the pupils The outline looks about as follows

I. What a Weed Is
   1. Definition
   2 Characteristics
   3. Sweet clover
   4. Oats and grass

II Why Weeds Are Enemies
   1. Prevent plant growth
   2 Take moisture
   3. Take plant food
   4. Shade plants
   5. Harbor insects

III Classes of Weeds
   1 Annuals
      *a*. Definition and nature
      *b* Examples (5)
      *c*. How to kill
         (1) Cultivation
         (2) Prevent going to seed
         (3) Burning
   2. Biennials
      *a* Definition and nature
      *b* Examples (5)
      *c*. How to kill
         (1) Why more difficult
         (2) Use of spud on lawns
         (3) Prevent going to seed
   3 Perennials
      *a*. Definition and nature
      *b* Examples (5)
      *c* How to kill
         (1) Great difficulty
         (2) Killing roots
         (3) Smothering
         (4) Use of salt and acid
         (5) Three best ways

As a result of this study together, which took about thirty minutes, the pupils have learned the need for close and careful silent reading, they see how topics and paragraphs are put together, they learn how to select the important points, they see the need for systematic outlining, and they have a better understanding of the general problem of mastering and organizing a unit of thought.

**Summary of suggestions.**

1 Teachers should understand and appreciate the fact that *ability to study effectively is of greater importance in life than any other ability which the school can give the child* Bagley says "To teach a child to study effectively is to do the most valuable thing that could be done to help him adjust himself to any environment of modern civilized life into which he may be thrown "

2 *Our system of examinations has tended to produce wrong habits of study.* Pupils tend to fill their minds mechanically with a jumble of unrelated, memorized facts Open-book examina-

tions, in which pupils must scan the text closely, analyze the subject matter, find problems and data for problem solving, and pass judgment upon the relative importance of the textbook statements, are often of more value than the common stereotyped essay variety. The use of modern new-type objective tests is also quite commonly overdone

3. *Pupils study best when they have a motive for study.* If the older pupils, for example, are to find out whether the schoolroom is adequately lighted, or if they are to make booklets in agriculture to place on exhibition at a mothers' meeting, there is some good reason for study; it is likely to be profitable

4 *Study the dictionary with the pupils frequently* Teach them all the parts of the book and how to find all sorts of information most expeditiously Supervised dictionary work involves interests, attitudes, abilities, as well as merely knowledge, there are several forms of dictionary skills

5 *Teach pupils to find suitable captions for paragraphs, stanzas, stories, anecdotes* They will need to read successfully in order to get the main idea or thought This is one form of study and it is an important one in school work

6 *Teach and train pupils how to test themselves* Can they determine whether they know a lesson or a topic? Pupils should be taught to know that they know and to realize the situation when they don't know Upper grade pupils can learn to make out their own testing questions

7 *One of the arts of study is that of taking notes* Pupils should be taught and trained how to set down the leading, suggestive points of a cyclopedia article, for example, or of what the teacher or some pupil gives in the way of useful information, and then to organize these notes into a simple, compact outline, which will be kept in a well-bound notebook. The teacher should read Chapter II in Kitson's *How to Use Your Mind.*[1]

8. *Learn to find the milk in the coconut.* Get the values of paragraphs Some words, sentences, and paragraphs are much more important than others Get at the essentials and learn

[1] KITSON, H D —*How to Use Your Mind,* J B Lippincott Company.

these Teachers need to give repeated guidance in selecting the salient facts

9 *Good physical conditions are of basic importance* Effective work requires obedience to well-recognized laws of health in matters of sleep, diet, fresh air, and adequate exercise Physical surroundings should be sanitary and healthful Temperature and ventilation require intelligent attention Illumination should be adequate, with the light at the left A good chair and table are necessary, as well as books, rulers, paper, and pencils

10 *The best workers are calm and persistent* They neither hurry nor worry The cool unhurried student gets results with less waste of nervous energy To go at a task promptly and vigorously will insure a good beginning Loafing and dawdling are fatal, energy and the will to learn are indispensable A rocking-chair is not conducive to concentration When you begin to read sentences over and over without sensing the meanings, open up the windows and go out for a brisk walk. Also, change the subject. Remember that the best way to begin is *just to begin*, that is, start working, go through the motions Interest will develop as you get warmed up to the task

11 *Knowing the teacher's requirements* (To pupils) Be definite and clear as to the assignment and what the teacher will expect of you in class It is always best to write down the assignment in a special book, indicating what is to be simply read, what memorized, etc You are not preparing simply to recite. You are studying to learn, to develop your personality You are working primarily for yourself and not for the teacher. Older pupils should keep assignment books in which they set down directions for study, subject matter simply to be read, facts to be memorized, sketches to be made, and so on. This is valuable training in study Children cannot do successful work in study unless they have a specific task and the means at hand for doing the work They must have clear aims or purposes, and know just what to do in order to realize these

In case the teacher does not make the purpose clear, ask about

it No work should ever be done for no reason at all Form the habit of formulating objectives or setting up goals Then as you work, do not lose sight of your goals In all your study try to adapt means to ends Use tools that will realize your aims most quickly and most effectively

12 *Practice most on that in which you are weakest.* (To pupils) Find out the weak points in your knowledge and your abilities In a spelling lesson perhaps you already know several words Select the words difficult for *you*, and work on them only

13 *View the subject matter from various angles* (To pupils) To think over what one is learning is a very useful habit Relate what you learn to the affairs of life as much as you can Illustrate rules, definitions, and principles Unless you do this, you do not know them Abstract statements are relatively meaningless until worked over into concrete instances

14 *Think of the kinds of questions your teacher will ask* (To pupils) Form the habit of putting questions to yourself, as you study Try always to translate the book material into practical forms In the business of life we do not have use for $8 \times 7 = 56$, *in that form*, as a rule The business man often uses forms different from those taught in the schools and pupils should know something of the modern way of doing business

15. *If possible the lesson should be quickly gone over before class time* Some portions need repetition, perhaps orally A list of related points may require rapid and repeated scanning, in the same order each time The pupil should practice to deliver the results of study in the form directed by the teacher

16 *Judgment is more important than mere memory* Make memory serve the judgment Analyze topics, and practice subordination of topics Study according to a sound system, and review by getting a new view from a higher level of thinking.

17 *There should be an appeal to and through the various avenues of sense, as the eye and ear* There is a good reason for reading some material aloud Material to be learned should be gone over, not laboriously, but quickly and repeatedly. Oral repetition will often help

18 *It is often necessary to go beyond the state of just being able to do or to repeat* One is sure and safe, to illustrate, only when he can run his car automatically You and those whom you meet on the road are safe when the various processes are "handed over to the effortless custody of automatism," leaving your higher self to look out for the other fellow In committing a selection for public delivery, automatic learning is highly important See discussion in this text on the subject of *overlearning*

19 *The method of the whole is more effective than the method of small portions* The approved practice in memorizing a poem, for example, is first reading the entire poem rapidly several times, and then the thoughtful repeating of a few logical units or combinations of stanzas If the aim is to understand and digest material, but not to memorize it, the best way is to go through it all rather rapidly at first to get a bird's-eye view of the related whole Then the student should concentrate upon the subject matter topic by topic, bringing it all together finally in a summarized view with a good condensed outline Teachers should devote the necessary time to the development of this technique

20 *Different types of materials need different treatment* Teachers and older pupils should realize that knowing how to study and learn an arithmetic lesson on, say, addition of mixed numbers is an entirely different study problem from that found, for example, in an understanding and appreciation of "The Midnight Ride of Paul Revere" Different types of subject matter demand different treatment and different study skills and techniques

21 *Direct pupils in assisting each other* Develop the spirit of co-operation and helpfulness It so often is the case that a brighter pupil can give a suggestion which will be of decided help to a slower pupil in overcoming his study difficulties

22 *Get the pupil's viewpoint* The teacher should form the habit of thinking about subject matter from the angle of its study and acquisition by her pupils. She should consider whether

the particular lesson is one calling for inductive treatment, habituation activities, memorization, problem-solving methods, or something else. In other words, the teacher needs to view learning materials from the standpoint of the particular phase of learning and also from the viewpoint of the individuals who are to do the learning.

23 *What is given, what is required?* Give children repeated practice in telling what is given and what is to be found Teach them to formulate as many problem questions as may be needed In reading classes as well as in arithmetic classes many problems occur Pupils should be guided in finding them and expressing them in good English

24 *Grade subject-matter values* Repeated practice should be given in arranging statements and paragraphs in the order of their importance Daily opportunity for pupils to judge of the value of printed materials whenever found is of much value in the formation of critical study habits

25 *Textbooks need interpretation and elucidation.* Remember that even the best textbooks may be difficult for some of the children It should be a constant, daily teaching activity for the one who is guiding the study and learning of children to make the textbook a real tool for genuine learning This will require directed study for both groups and individuals Do not hesitate to vary from the order of the textbook if the class can learn better in some other order Textbooks are not infallible; it often happens that topics can be mastered in a variety of equally useful arrangements

26 *Study readers are of much value* Today we have many series of readers through the use of which pupils are taught valuable study skills These readers are given different names such as study readers, work-type readers, problem readers, and so on. The informational form of textual material in science, nature study, geography, and history is often used, and deliberate attempts are made to develop definite study skills and attitudes These readers have done much good, but in their subsequent educational career pupils will also need special in-

struction in the study of these different subjects No doubt the training which these study readers afford in the understanding and organizing of special subject materials is of much value and there will often be a distinct carry-over of study skills But in all subjects and all schools definite teaching should develop specific skills *as they are needed*

27 *Do not forget that directed study is not merely an administrative method* The purpose of directed study is the improvement of the individual pupil, it is a *teaching* procedure. Successful directed study results in learning and it may be and often is an informal procedure The nature and value of any directed study activities will be determined by the educational objectives of the teacher and the learning needs of each child at a given time and in relation to particular lessons

28 *Socialized expression in varied form is a necessity* Always the rural teacher must understand, must realize, that her daily program should provide for *expression* as well as acquisition or *impression* through study There must be talking, dramatization, audience reading, recitation of many literary selections and masterpieces, demonstrations, repeated so-called "floor-talks," reports, and so on to great length Socialized expression should be a daily affair

29 *Assignments may be for both study and preparation for study* The teacher would do well to look upon the assignment as a teaching or a directed study activity In making assignments the teacher should do everything possible to make the pupil's individual study successful and not too difficult Good assignments take time, but it is a very profitable way to use school time [1] Rural teachers can save much time for themselves if they will make use of *written* assignments and directions Study problems can be furnished pupils in this way by the use of the hectograph Provide for differing abilities through differentiated assignments of study tasks Slower pupils can master essentials and brighter pupils can do more of the same kind of work or do something entirely different Every rural school

[1] See the author's book, *The Country Teacher at Work*

should have one or two first-class hectographs and a supply of ink and paper

30 *The rural teacher should try to provide pupils with plenty of study helps in adequate variety* There should be on hand good dictionaries and encyclopedias which the pupils are carefully instructed in using Then for every subject such as history, geography, agriculture, and civics, there should be several sets of different modern texts, if possible. The library itself should contain a well-selected and well-graded stock of several hundred books Pupils should be definitely taught just how to use the different books Each child above the third grade should have his own dictionary When pupils are old enough, they should learn how to use the card-catalogue index and other indexes Every rural school needs a few good magazines An adequate supply of paper, pencils, ink, notebooks is a constant need.

## REVIEW, TEST, AND PROBLEM EXERCISES

1 Why is a rural teacher justified in taking a great deal of school time to teach pupils how to study? Will this be an economical use of time? Which is better, *directed study* or *supervised study?*

2 How can a teacher prepare pupils for successful study through adequate assignment? Try assigning "October's Bright Blue Weather." Such assignment may very properly take an entire preparatory class period of twenty minutes or more.

3 (*a*) Indicate five things you can do to teach your pupils how to use the library. (*b*) Indicate five lines of procedure which you would use in teaching pupils how to use a dictionary (*c*) Name several different dictionary skills

4 Illustrate with an eighth-grade history lesson study questions that avoid calling for mere memory results. Use the period 1783–1789 for your subject materials

5 Suppose that the next lesson in reading is Joaquin Miller's "Columbus" Tell what you can do to stimulate an interest so that pupils will actually study the poem.

6 How can you avoid helping pupils too much when you are supervising individual study? Why should you have group supervision as much as practicable? Why must you give attention to individuals, also? Tell how you will find time to do this in a rural school. See the chapter on the daily program and also the one on the recitation

## REFERENCES FOR THE TEACHER'S READING AND STUDY

1 BOOK, W F—*Learning How to Study and Work Effectively*, Ginn and Company 1922
2 CRAWFORD, C C—*The Technique of Study*, Houghton Mifflin Company 1928
3. KITSON, H D—*How to Use Your Mind*, J B Lippincott Company Revised edition, 1926
4 MCMURRY, F M—*How to Study and Teaching How to Study;* Houghton Mifflin Company 1909
5 STILLMAN, BESSIE W—*Training Children to Study*, D C. Heath and Company 1928
6 YOAKAM, G A, AND SIMPSON, R G—*An Introduction to Teaching and Learning*, The Macmillan Company. 1935.

# CHAPTER XXII

## RECITATION OBJECTIVES AND PRACTICES

**"Passing of the recitation."** Some years ago V T Thayer wrote a book [1] to which he gave the title of this topic In his discussion Dr Thayer considers the origin of the recitation, learning as an active instead of a static process, criticisms of group instruction, supervised study, the Dalton and Winnetka plans of individual instruction, the socialized recitation, the project method, some essentials in teaching suggested by the methods discussed, the lesson plan and the assignment, the working period, and the socialized period This author makes it very evident that much dissatisfaction prevails concerning the futility and relative failure of the formal traditional recitation procedure, with its oral question-and-answer type of recitation activity which stresses largely the reproduction of textual information Such a recitation ought to pass into total and eternal oblivion, but although it is no doubt gradually passing in many localities, it is still widely prevalent. Many rural teachers are still using out-of-date teaching-learning procedures The recitation period for group activities should not pass away, certainly The orthodox recitation needs to be reformed With a change of objectives and a change of practices, the recitation will serve a useful and a necessary function always

**Meaning of recitation.** The root meaning of *recitation* calls attention merely to the repeating of what has once been said or cited Literally, *recite* means to *call* or *cite again*. That is, the original etymological meaning has reference to the saying again of what has once been said or given to the pupil. This idea does not necessarily involve the notion of meanings, of thought, or of real learning The "saying again" is merely the repetition of a

[1] THAYER, V T.—*The Passing of the Recitation,* D C Heath and Company 1928.

purely verbal-memory product—a pretty dreary business, we must admit. Our present conception of the recitation embraces a variety of aims and of activities, such as testing to discover the pupil's knowledge and skill, verifying and correcting the pupil's ideas, removing wrong notions, furnishing collateral material, habituation exercises to fix facts in mind, stimulating the pupil to renewed efforts, cultivating power and skill in the use of English, helping pupils to study by themselves, training in thinking or problem solving, and furnishing socializing opportunities for discussion and the forming and expressing of personal judgments. It can readily be seen that this involves much more, very much more, than hearing book lessons.

In one sense the recitation is but a period of time, but a teacher never grasps her rich opportunity until she thinks of the recitation in terms of pupil activity, change, and improvement. The real recitation is a means for promoting the natural development of the child's abilities. It is an exercise during which pupils present the results of their study or investigation. It is a period for general discussion, for the presentation of ideas found in many sources, and for the correction of wrong ideas. The recitation procedure in this better sense does make use of subject matter, but it is not to be thought of as a mechanical verbal memory-recall process, in any case. In the commoner acceptance of the term, perhaps, we think of the recitation as a class exercise in which the teacher may instruct or teach, test, and drill. To *teach*, however, in the widest meaning of the term, is to bring about any sort of pupil activity or response which will *change* the child's life and personality. If teaching is effective, the child actually *learns*.

**Objectives of the recitation.** Among the generally accepted aims of the recitation, as we understand its function today, are the following, not arranged in any definite, significant order:

1. To give opportunity for teacher and pupils to get ready for a study of the pending unit of subject matter. This may be an inductive, preparatory teaching-learning exercise. In fact, it is very likely to be in the nature of a development lesson.

2 To afford the teacher a chance to give detailed, explicit assignments of work, telling pupils not only what to do, but how to do it, and where to find necessary learning materials

3 To give pupils a chance to report what they have accomplished, in this way stimulating others by accounts of progress. The recitation should motivate learning processes as well as guide and direct them

4 To check workbooks and other materials prepared by pupils. Today children prepare much that is useful and valuable during their directed study periods

5 To work out study outlines and review outlines together as a learning exercise Here is an opportunity for some real teaching

6 To furnish occasion for pupils to tell how they studied their lessons, where they secured information, and what difficulties they encountered and to give other similar helpful information

7 To check up on the results secured in the study of a unit of learning materials to see what progress is being made and what help may be needed

8 To enable the teacher to give general directions on how to study, how to use reference material, how to do written work, how to keep notebooks, how to fill out workbooks, and to give other helpful suggestions for promoting learning activities

9 To afford practice in the use of English, both oral and written Forms of expression, particularly effective speech, need constant attention Pupils will never learn to talk well unless they talk much under the stimulation and guidance of clear, correct standards Pupils will not learn to talk by listening to the teacher, or by answering scrappy questions in fragmentary fashion Pupils should be permitted and encouraged to talk on a great variety of subjects Such talking should of course be guided and directed

10. To give practice in silent reading Pupils should be asked repeatedly in a class exercise to examine the printed page with a distinct purpose in mind, to answer a specific question, or to solve a particular problem The ability to get the meaning of a

sentence or paragraph is of such fundamental importance in all the work of the school that the recitation period should frequently offer opportunity for the acquisition of the various silent reading skills

11 To stimulate and guide pupils in forming the habit of initiative The old-time recitation developed very little initiative With the new social purpose of the school in mind, no teacher should fail to see the need for the development of this personality trait The members of the class should ask questions and suggest problems Pupils will never develop initiative if the teacher continually directs all the activities The child needs to be given a chance repeatedly to choose for himself, in some measure to map out his own program, otherwise he becomes increasingly dependent

12. To instruct pupils in the use of books The recitation period is the time to teach pupils how to handle books and how to run down topics, using the table of contents, the index, the appendices A child, in order to get book power, must learn to feel at home with books A book must be looked upon as a friend ready to render assistance, providing it is accorded understanding and skillful treatment Skill in the use of books is one of the many which the school should develop, it is a distinct objective of the recitation

13 To furnish opportunity for a study-recitation exercise of any kind and for any purpose whenever the need arises

14 To give the teacher many opportunities for supplying collateral information out of her store of knowledge or by the use of books, objects, pictures, and experiments and in other ways The one textbook needs to be supplemented; the teacher's oral presentation is one means of doing this

15 To guide and direct pupils specifically in detailed problem-solving activities In this connection pupils should be stimulated in doing original thinking and in carrying out personal investigations for the benefit of the individual and the group

16 To call attention to matters of central or pivotal importance so that pupils will be able to distinguish the important

from the relatively unimportant in their lessons or in other forms of subject matter

17 To carry out any form of teaching-learning procedure which will prepare pupils and definitely aid them in whatever study activities they may engage in by themselves at their seats

18 To furnish the occasion and the stimulus for many and varied forms of socialized activities Pupils should feel very free to ask questions and to express opinions based upon definite information

19 To give opportunity for the teacher to do for the whole group, by way of direction, suggestion, and stimulation, anything which can be more economically and effectively done in this way rather than for individuals

20 The recitation period is a time for a much broader teaching-learning activity than that involved in testing and drill Tests and drills are not now conducted by the oral question-and-answer method There are much more effective procedures. The recitation has an important function in directing study, in socialization activities, in diagnostic and remedial teaching, in observational learning, in problem solving, in experimental and creative learning, and in appreciation exercises The recitation may be a conversational discussion exercise and there may be various forms of dramatized expression and learning The old testing aim is gradually disappearing, we now think of the recitation as primarily a time for a great variety of teaching-learning activities and processes

**Recitation processes.** During a recitation period, as it is generally understood in the American rural school, the teacher can, among her other activities, do at least three things so far as the actual instruction is concerned She can teach, she can drill, and she can test Sometimes these are called teaching processes; sometimes they are thought of as certain general aims of the recitation Practically all of the usual teaching types may be grouped under these heads The telling or oral-teaching exercise or lesson, the object lesson, the development lesson,

both inductive and deductive, the study lesson, whether supervised or unsupervised, the assignment lesson, and the review lesson may all be thought of as teaching exercises, although the end is often much more than the mere acquisition of knowledge Socializing exercises and appreciation lessons are also, in the broad sense, teaching procedures, though it can readily be seen that the knowledge aim, as such, is not the uppermost idea Teaching, or instruction, has a much more comprehensive purpose than the mere imparting of knowledge. Its all-inclusive aim is to enlarge the pupil's personality

As a result of genuine teaching the child is developed in all phases of his mental, moral, and spiritual nature It is not simply a question of intellectual training, that is, the development of the knowing powers, the feelings are also aroused and developed by good teaching, will attitudes are formed, habits, ideals, and interests are shaped, the child is equipped to solve problems of his human relationships In recent years much has been made of socializing activities and procedures, for it is now seen that the pupil must be prepared for social efficiency Appreciation lessons are becoming increasingly common, a technique for such lessons is now in common use Habit-forming exercises necessarily involve repetition, and review exercises may comprise teaching, or testing, or repetition, or all of these Question-and-answer exercises whether used in review lessons, appreciation lessons, study or problem-solving exercises, or in other ways, may be of the nature of either instruction, or testing, or drilling, or all three Thus it is seen that the processes or procedures of the recitation comprise teaching, drilling, and testing, although at the present time recitation procedures are not considered solely or chiefly according to this classification. We now think of teaching as including every possible means to the end that genuine child learning may result

**The study-recitation.** Every rural teacher should know and appreciate the possibilities of the directed study-recitation By this term is meant an exercise or a special use of the recitation period, during which teacher and pupils work together upon

some subject matter, problem, or project During a study-recitation the teacher has opportunity for supervised group study When testing or drill activities do not go well, the teacher should stop her efforts in that direction and actually work over and work out the material with the children Both teacher and pupils should ask questions and answer questions There should be a general give-and-take, with an effort to understand, to organize, to gather data for the solving of a problem, and so on. Other books may be used, outlines may be made out, problem-questions formulated, pupils taught how to take notes, and the like If the teacher would spend more time in a supervised study-recitation the testing exercise would have more meaning and would go forward with greater effectiveness and success There is too much pumping from dry wells, or to use another figure, too often a quite futile attempt to squeeze blood out of a turnip. More real teaching and more supervised study would greatly increase the value of the testing recitation period. When pupils don't know, quite obviously the only thing to do is to teach and not to attempt merely to test Testing procedures are greatly overworked in many schools

**Subject matter and learning.** Many teachers look upon subject matter as a static, fixed quantity, not subject to change A thoughtful teacher will understand that subject matter has come into the schools because of the needs of society, and that changes and growth are always going on in the social organism Society is not fixed; it is in a constant state of flux. "New occasions teach new duties," and as mankind makes new discoveries and new advances in civilization, so the subject matter for the school changes New topics are constantly being introduced and old topics dropped out We have changed the content in geography, in arithmetic, in civics, and in many other subjects. If the teacher will look upon subject matter from the dynamic, functional point of view rather than from the static, she will think differently about her work and will render the pupils a greater service. Worth-while subject matter is not dead subject matter, for it functions when put to some profitable use Static

subject matter is dead, inert, useless; much of this kind of material is still being taught in schools today

Subject matter in the rural school should serve a useful purpose, that is, be practical and relate to the child's environment and to his future place in society Subject matter should serve the child and promote his personal development so that he will increase in personal power—power to understand, to work, to enjoy, to serve, and to be useful in the world No rural teacher is justified in teaching a topic just because it is in the course of study, although, to be sure, she may be legally required to adhere to a prescribed course She should be constantly thinking of the materials she uses in terms of changes in the child's personality Some kinds of subject matter are much more useful than other kinds of subject matter Knowledge of his own state is usually more useful geographic knowledge to a child than knowledge of Africa, for example Ability to write a good paragraph is a much more valuable accomplishment than ability to parse Ability to handle fractions and denominate numbers has a more intimate bearing on life than ability to extract square or cube roots. The habits of close observation and of attention, which result from good teaching, are worth more than the facts themselves stored in the mind, particularly if these facts are unrelated, unorganized, and not used in solving practical problems

**Hearing lessons vs. teaching.** It is no doubt true that the average rural teacher, even at the present time, is spending a good deal, perhaps most, of her time in hearing pupils recite book lessons The lesson is usually assigned by pages or topics and the pupil is given but little help in the mastery of the printed page The idea of problem making and problem solving or even of thinking aside from its relation to specific personal problems quite likely does not enter the mind of the average rural teacher To be sure, there are now many teachers, and the number is constantly increasing, who see in the recitation procedure exceptional opportunities for pupil development But for the most part, we still have to a large extent a question-and-answer

process in which the chief activity is purely a memory response of undigested textbook facts

What is needed most of all today is intelligent procedure, based upon the principles of learning and the result of study and analysis on the part of the teacher Until such a time comes in the life of a teacher, she is not really teaching She is only a hearer of book lessons which are often a sorry spectacle of mechanical, unthinking routine, devoid of all valuable educational results In this connection, it should be made plain that there is really no general technique which a teacher can learn that will serve all purposes Different subjects require different procedures adapted to particular types of subject matter, to the capability of the child, and to the pupil's stage of learning There is real need at the present time for an eclectic plan of teaching for rural teachers which will involve the use of both activity and subject units and which will make sensible and practical adaptations of problem-project procedures

**The teacher's opportunity.** In the average rural school we still find many, too many, so-called recitation periods during the day, most of them of only ten or fifteen minutes' duration During the recitation period the teacher calls the pupils to the recitation seats, apart from the rest of the school, and there she does the best she can to teach her class What takes place during such a period will be determined by the teacher's ideals, her objectives, and her standards of procedure If she has never studied the real meaning of teaching and has never had a skillful teacher herself, she will be quite likely to confine herself to textbook material and to expect pupils to memorize the text to a greater or less degree. During the recitation teacher and pupils should come into close mental contact Then is the time when the teacher has opportunity to impress her personality upon that of the pupil The recitation period is a golden opportunity to instruct, to guide, to inspire The child's mental horizon can be widened, his imagination can be awakened, his thinking powers developed, his feelings aroused and cultivated, his attitudes formed, and his whole life lifted to a higher plane To do

this successfully the teacher must have clear and correct educational objectives, she must know the varied and proper procedures, and she must have skill in the techniques of teaching and in the direction of learning

**Need for diagnosis.** One of the large problems of the teacher is that of ascertaining what the child now knows and can do, this means not only the child's stock of ideas but also his attitudes, his ways of thinking, his ideals, his likes and dislikes Every good physician is a good diagnostician He does not treat symptoms merely, he ascertains causes which lie beneath the surface In school work it is of the greatest importance that the teacher know her pupils Today we are making increasing use of diagnostic tests At the present time tests have been devised which are more effective than the old-time tests, in that they discover not only the content of ideas, but also habits of thought, methods of thinking, reading and study skills, and other learning abilities

In all successful instruction the teacher must proceed from the known to the related unknown By means of tentative, diagnostic questions the teacher may find out what the child knows from which he can take his departure in developing a new body of knowledge It should not be forgotten that no two pupils possess the same stock of ideas, because no two children have by any possibility had exactly the same experiences When a teacher begins a new topic, such as long division, for example, she should first of all make sure that there is an adequate basis for the new work Long division, with its several gradations or steps of difficulties, is a good illustration of the need for detailed, specific diagnosis If the reader will make a graduated scale of examples in long division, he will appreciate the need for diagnostic procedures Arrange a series of a dozen or more examples in order of difficulty Inventory tests in arithmetic and other subjects do this very thing, so that by their use a teacher can make a rather accurate diagnosis of each child's weaknesses and needs

**Importance of accuracy.** When the class exercise or the recitation procedure of a rural school is definitely visualized in all its details and variations it seems quite evident that several

aims are clearly possible However, most objectives may be summed up in the terms *knowledge, ideals*, and *skills* In the writings of Emerson E White [1] of more than a generation ago we find knowledge, power, and skill stressed over and over again; but now we know that ideals, attitudes, appreciations, and interests are of equal significance in the life of the child Moreover, we have come to see clearly that skill in general is an abstract impossibility Skills are concrete, special, particular, and realizable only through specific procedures and pupil activities Every good recitation stresses the importance of accuracy in the acquisition of knowledge Pupils should be trained to learn correctly and as fully as their stage of progress will permit When a child develops respect for a fact and really desires to know the truth, it is a distinctive day in his progress

Children should not be permitted to guess as a general thing, at least not in fields where they can and should know They either know or they don't know, if they know accurately and well, they can tell, for knowledge presupposes the words in which to clothe the ideas As one writer well says "Ideas are born with their skins on" Early in their school career and all through it pupils should have daily training in the formation of clear-cut images, and in the gathering of data from which to draw definite conclusions If a teacher teaches her pupils to see things as they are and to get thought from the printed page, she is doing much for them Many pupils "go through" both the common school and the high school without gaining the ability to get the meanings which a sentence or a paragraph should yield But over and above knowledge, how important is the development of ideals, attitudes, habits, interests, tastes, likes, and dislikes, both in making a living and in making a life The recitation is at least one opportunity of the teacher to give the child's mind a *set* in the right direction, perhaps for life

**Topical recitations.** One county superintendent recently told the writer with considerable enthusiasm of the successful

[1] White, E E—*Elements of Pedagogy, School Management,* and *Art of Teaching,* American Book Company.

use of the topical recitation in the upper grades of the rural schools in her county This form of recitation is not new and it is not acceptable to the proponents of the more progressive practices of the so-called "new education" It is a type of procedure which is apt to degenerate into a formal, unthinking reproduction of textual materials However, in the hands of thoughtful teachers it has fruitful educational possibilities, particularly if, instead of one textbook, several are used along with a good selection of other reference materials The risk is found in the assign-study-recite formula which may be anything but educational in its general influence

In *Standard Practices in Teaching*[1] a chapter is devoted to the topical recitation, and the following suggestions are briefly discussed. (1) Provide for organization of knowledge, (2) insure organization in the recitation; (3) avoid a uniform order in calling for recitations; (4) relieve the formalism of the procedure, (5) avoid a dictatorial attitude, (6) encourage pupils to ask for further explanation about points not understood, (7) be aware of the attitudes that are being developed during the recitation period; (8) encourage independent, clear, forceful presentation, (9) encourage the stating of material in a new way, (10) the pupil should speak the language of the subject, (11) close each topical recitation with a summary of the work covered, (12) do not grade pupils during the recitation; and (13) the topical-recitation technique is not an exclusive technique

**Oral and textbook instruction.** Every good teacher must necessarily instruct by "word of mouth" and she must certainly make use of a great variety of textbooks, the more the better, if they are of good quality and up-to-date. Through oral instruction the teacher does much to supplement the text by way of explanation, clearing away certain difficulties, and interpreting obscure portions and passages Teachers are often prone to talk altogether too much; they are apt to forget that telling is not necessarily teaching at all Good oral instruction

[1] BAGLEY, W C, AND MACDONALD, MARION E—*Standard Practices in Teaching*, The Macmillan Company 1932

often takes the form of skillful questioning instead of lecturing. It is the teacher's function to see that the pupil can use his textbook successfully so that it is genuinely a tool for learning. Unless the child can read his textbook understandingly, unless he is able to make textual materials his own and actually use them in profitable thinking, the text is merely a jumble of words and a hindrance in the learning processes. The teacher's business is to help the child to read and interpret the text. Many textbooks are too difficult for pupils; then the recitation is often nothing more than the reproduction of paragraphs entirely beyond the child's comprehension. Use many recitation periods to read and study the textbook with the pupils.

**The pupil in the recitation.** The class period is a time when the pupil should learn how to study; he should have his difficulties cleared up. During this group exercise the child should add to his useful knowledge and get definite guidance in the formation of ideals, habits, skills, and attitudes. He should be made to feel at ease and encouraged to participate to the extent of his ability. He should learn habits of courteous response and co-operation. Often the concomitant, indirect learnings are more important than the acquisitions of textbook knowledge. The teacher should take pains to see that the atmosphere of the recitation is really free, wholesome, and uplifting. The pupil should ask questions when he needs information and he should contribute his share to the general class fund of educational results. The pupil should be taught to speak clearly, to sit in some becoming posture, to stand erect when standing is in order, and in general to conduct himself as a well-mannered member of the social group. Every pupil should take part in the general discussion. He should both answer and ask his share of questions. He should feel a sense of real personal responsibility for the successful use of the time devoted to the class exercise.

**The teacher's function.** What should a teacher do during the class or recitation exercise or period? Many teachers have a misconception of their true function. The teacher's main task is to direct and to stimulate learning. For every group meeting

there should be a plan and a purpose Otherwise, it would be best not to meet The teacher is the director of activities She should know very clearly what she is trying to accomplish, and then she should move in the direction of her objectives as directly and as persistently as possible The teacher must decide whether she wishes to direct study, to develop appreciations, to review, to assign some new work, or to test Then she must settle just how she will realize her objectives, that is, what procedures she will use In any event, the teacher needs to know that her constant aim is to have the pupils learn something very definitely It is often useful to have the plan for the period set down in its larger outlines so as to serve as a guide This general outline may be at hand for reference If instructional or testing questions are to be used, it is well to have most of them made out in advance Sometimes these may be written on a reversible cloth blackboard or on large sheets of Manila paper The teacher must be ready with a plan and a purpose or the period will be time wasted, if perchance a supervisor should drop in, the unprepared teacher will be embarrassed and chagrined

**Questions and questioning.** The traditional method of conducting a recitation exclusively by the use of oral questions and answers is happily becoming a thing of the past However, in the use of even the most modern of teaching techniques it is necessary to ask questions Not all teachers know how to question skillfully

1 *Function of the question* Every good teacher is able to talk clearly and to the point, she is also trained to ask good questions One writer says that a question is a demand for thinking or the results of thinking. Betts [1] states that "good questioning stimulates thought, leads to inquiry, and results in understanding and mastery . . Poor questioning leaves the mental powers unawakened, cripples thought, and results in inefficiency and lack of mastery"

2 *Good questions* A good question demands thinking and thus brings attention to bear upon the problem under considera-

[1] BETTS, G H —*The Recitation*, Houghton Mifflin Company.

tion. Skillful questioning breaks up subject matter into logical steps, and serves as a stimulus to the pupil A clear, sharp, pointed question stings a child's mind into action .

3. *Why ask questions* The teacher needs to question pupils in order to find out both what they know and what they don't know The ascertained known will prove the point of departure for teaching something new. If pupils have wrong notions, these can be corrected when discovered by questioning Proper questions discover how the pupil thinks and where the teacher has failed to stimulate and guide thinking in his teaching Teacher and class co-operate in a well-conducted question-and-answer procedure; good questions secure such co-operation

4 *Kinds of questions* Many types of questions have been differentiated by different writers We have thought questions and memory questions, what and when questions, how and why questions, review, test, and drill questions, topical questions and organizing and evaluating questions, appreciation questions; leading questions; interpretation and inference questions; and so on One writer distinguishes three kinds of questions—(*a*) tentative, or preliminary; (*b*) instructive, or Socratic, and (*c*) testing, or examination

5. *Tentative questions* are framed to ascertain the child's present knowledge as a preliminary to the presentation of new material It is unwise to assume either that a pupil knows or that he doesn't know The best way is to find out by good questioning, orally or by writing, exactly what he knows

6 *Teaching questions.* Socrates, Greek philosopher and teacher, was skillful in the use of questions as a means of teaching the youth of Athens. A good teacher uses instructive questions mostly, as they both stimulate and guide the pupil in his quest for knowledge. They should be arranged in logical order, arouse interest, and require and provoke thought.

7 *Testing or examination questions* may be both oral and written and may be given at regular or irregular intervals The old examination question was too general and too uncertain as a testing instrument The new forms of examination promise

something more scientific and accurate Oral test questions are necessarily used by the good teacher to some extent, but not nearly so much as formerly They are usually too detailed, calling largely for scrappy, memorized answers. This is not necessary, it is not productive of educational results Testing questions should call not only for the items of knowledge, but for the thinking processes also. Good expression in answering is worth striving for, but not too insistently

8 *Good and bad questions* A good question has a definite aim, is specific, adapted to its purpose, briefly put, not wordy, and clear in form, and it requires a precise, particular response A poor question is usually one that is complicated, hard to understand because couched in vague, uncertain language Having made her question clear and to the point, the teacher should ask it only once, as a rule Repeating questions is a bad practice that seldom has justification. Some teachers repeat questions automatically and apparently unconsciously, a foolish practice

9 *Leading questions* Lawyers ask leading questions because they wish to bring out certain facts or information The teacher is justified in asking leading questions to provoke thinking, but such questions are bad if they merely suggest the answer in mechanical fashion

10 *How answer?* *Yes* and *no* answers are sometimes good, sometimes bad, depending on the teacher's purpose. Answers in complete statements may be a waste of time, if teacher and pupils are trying to push on to the solution of a problem or to the development of a unit of subject matter *Yes* and *no* will serve to carry on the discussion, and are properly in order in such cases

11 *Study questions* Modern textbooks contain many useful study questions which are often in the nature of problems Teacher and pupils should make intelligent use of these The use of such study questions does not preclude the framing and answering of many others, however, on the part of both teacher and class Many of the older book questions were mechanical and should be avoided

12. *Pupil's responses* Pupils should be trained to answer questions thoughtfully and courteously A proper response on the pupil's part is as much of an art as the questioning itself; it is a matter for daily attention and training Children should be required to stand straight on both feet, or to sit properly, if sitting is best, and to speak in a clear, conversational tone, neither too loud nor too low As a rule pupils should not be permitted to guess, unless all understand that the guessing is legitimate in the given situation If pupils answer in muddled, indistinct, incoherent fashion, it is the teacher's duty to get something better The manner of answering is often as important as the substance of the answer There is a great deal of irrelevant, foolish, inaccurate answering in many schools by pupils who have failed to master the subject matter, possibly because the teacher has not taught them how to study

13. *Reception of answers.* Teachers need to study the art of receiving answers properly. If an answer is wrong the pupil may be led to correct it The entire exercise should be a pleasant conversation carried on in courteous tones and language. If one pupil cannot answer, another may be called upon unless the answer can be secured by means of a development exercise The waving of hands and all show of impatience should be discouraged The attitude of members of the class toward the teacher and toward one another is an important matter If pupils answer thoughtlessly and carelessly, if they are evidently unprepared, the teacher must teach and direct. If a child answers honestly though incorrectly, the teacher's duty is to show him his error, possibly by further questions, possibly by direct telling A wrong answer is the basis for further teaching; before the truth is brought to the surface, several questions may be needed. The pupil may be asked to try repeatedly, to make special effort to recall, to think It is a waste of time and effort to repeat questions or answers in mechanical fashion as a matter of habit, neither teacher nor pupils should fall into this senseless practice Some teachers have the "all-right" habit. Don't become an "all-righter"

## REVIEW, TEST, AND PROBLEM EXERCISES

1. In what ways does the recitation period offer the teacher a genuine opportunity? What is a rural teacher's constant temptation when the class is called out to recite? How can she overcome this daily temptation?

2 Indicate different lines of learning activities which can be carried out in an upper-grade arithmetic class during the recitation period

3 Why is a study-recitation often much more valuable than the common testing recitation? Make a list of as many activities as you can think of which may find a place in a study-recitation

4 Why are attitudes, ideals, habits, abilities, interests of so much importance in any person's life? Show the futility of knowledge and nothing more in such subjects as physiology or civics

5 Write a list of several useful items of subject matter in geography, and a list of five facts which will make but little difference if they are not taught at all Draw both lists from textual subject matter Give your full reasons for so listing these items.

6 What is the advantage of a minimum list of words to teach pupils to spell? How many words do you think should be in that list for an eighth grade? What facts determine such a list?

7 Why should all teaching, so far as practicable, be related to the child's experience and involve new experiences through actual contact with our social and economic life? Why will it pay good dividends, for example, to take one's school to the county seat? Give several other illustrations of this principle

## REFERENCES FOR THE TEACHER'S READING AND STUDY


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# CHAPTER XXIII

## CHARACTER EDUCATION PRINCIPLES AND PROCEDURES

The thesis of this chapter is that character education or development of personality is the fundamental work of the American school Everything else is subordinate to this main objective The ultimate aim of education is the building of such personal character as will enable the individual to become an efficient participant in modern social living If with this efficiency there can also be a moderate degree of personal happiness and satisfaction, all the better All the machinery of our schools and all the procedures used by our teachers should further this all-inclusive purpose Personal character is not developed by chance On the contrary, it is the result of direct or indirect and conscious or unconscious observance of the well-known laws of learning Character is acquired, whether good or bad, it is acquired only through personal experience The teacher's task is to arrange continually for suitable and effective character-acquiring situations and to secure adequate responses to them If the schools of America are to make a vital contribution to the solution of our complex social and economic problems, teachers must think less of their task in terms of classes, grades, lessons, tests, and the like, and more in terms of actual personal preparation for solving real problems of human relationships In the consummation of such an enterprise the establishment of worthy ethical character is a high and vital objective

**Character and personality.** One's character is really what he is, his reputation is what people think he is A person's character may be better or worse than his reputation One's character is made up of both natural and acquired attributes When we use the word character we generally think of moral qualities such as

loyalty, tolerance, kindness, generosity, fidelity, faithfulness, and dozens of others The terms *personality* and *character* are often used synonymously, there is not great difference in their meaning Both words relate to the totality of ideas, ideals, and habits (mental, moral, and physical) which distinguish one individual from another. Ragsdale says "Perhaps as good a description of personality as we can give is that the word refers to the *total impression which one person makes upon others*" At bottom personality is more or less of a riddle about which the best thinkers have been speculating for ages Is one's personality another name for his soul? Well, your guess is as good as another's, for as a matter of fact, nobody knows One thing is clear: By various educational processes anybody's character or personality can be more or less modified. We may define personality as the summation of all those attributes of body, mind, and character by which one human being is differentiated from another

**What bearing has heredity?** We do not inherit express traits of character directly any more than we inherit tuberculosis directly as a disease In the latter case, children may inherit a physical constitution which will make it possible for them more easily to contract the disease For example, they may inherit a limited lung capacity, an inadequate or malfunctioning endocrine gland system, or a weak heart and a poor circulatory system In the case of character, the various character traits are largely the result of reactions to environment However, the child inherits a certain type of nervous system; it is by means of and through the agency of his particular personal nervous make-up that he reacts to environment and does all his learning, including that of shaping his ideas, his ideals, and his habits, all of which enter into the composition of any person's character. While no person inherits character in any literal and specific sense, every one of us inherits the makings of character That is, we inherit the type of central nervous system which will enable us to utilize our personal environment, in greater or less degree, in building up our characters by our personal reactions Our

characters are determined in part by heredity, but more particularly and essentially by our environments Character is acquired through experience, all learnings are the result of the multitudinous and often complex reactions of the nervous mechanism

**Respect for personality.** In the foreword of the *Tenth Yearbook* of the Department of Superintendence we find these words "One of the great notes sounded in the religions of western civilization is respect for personality Even in the kindergarten and nursery school respect for personality is the keynote While this note is not incorporated in all traditional education, it dominates contemporary education In all modern educational philosophy and teaching, the tendency is to emphasize respect for personality. No greater religious thought was ever presented than that of respect for personality, and no organization comparable in scope to the public school system has ever so thoroughly accepted it as a working principle as have the public schools of our country at this hour" Every teacher worthy of the name emulates the Master Teacher in her attitude toward the child She ministers to children coming from homes representing all grades of social standing, but the true teacher is dominated by the democratic spirit; in her sight, each child is entitled to be treated as a person possessing certain inalienable rights and privileges as well as having duties to perform and responsibilities to bear

**Character and nervous energy.** Every teacher should understand that there is a close and constant relation between a child's bodily condition and health and his conduct or behavior Many teachers do not give sufficient attention to this situation. It frequently happens that a child becomes a problem case because of lack of sufficient nourishment or because of adenoids, eye strain, or defective ears or teeth Every child in America is entitled to a careful physical examination by a competent physician, some day such an examination will also include the use of psychiatric tests as well Examinations should of course be followed by remedial measures if they are called for When a

child is causing trouble in school there is a reason for it, means should be taken to ascertain underlying causes. Many a child misbehaves in school or does not do good work because he does not get enough sleep or because his diet is inadequate There is often a lack of mineral salts and of vitamins in suitable varieties and amounts The child does not eat enough of fruits and vegetables His nervous system is not being properly nourished How can he learn and how can he behave as a normal child without a normally functioning nervous system? Today, in many progressive communities, medicine and surgery, together with proper personal hygiene and sanitation, have wrought wonderful changes in the lives of multitudes of boys and girls Character development has for its essential basis the healthful working of a well-nourished nervous system

**Character and the I. Q.** No doubt there is a close relationship between anyone's raw intellectual capacity and his ability to understand and appreciate moral values and standards of conduct In a general way, the conduct of every one of us is determined or modified in no small degree by the way in which we think, remember, form images, or give attention to situations If an individual's I Q is below 75 it will often be difficult for such a person to acquire the higher, nobler attributes of character It may be that such a citizen will discharge the ordinary duties of citizenship with some efficiency on a low level, but all through his or her life the finer appreciations, loyalties, and powers of strong characters will be impossible Just as a person of low I Q usually cannot do certain types of school work at all, so he or she will likewise be deprived of the insights of the higher types of personality because of an inherited deficiency of the central nervous system Such a thought has a tragic, fatalistic aspect, but it is unquestionably correct. Our characters or personalities are the result of nature plus nurture; although education can do wonders, it cannot accomplish the impossible

**Character and the behavioristic philosophy** According to the objective or behavioristic school of psychologists our entire mental and moral life can be explained in the materialistic terms

of physics, chemistry, anatomy, and physiology These philosophers, headed by Dr. J B. Watson, do not try to disprove the existence of a soul They merely ignore the mind or soul as an entity because they do not find any place for it in their scheme of thought Whether the behaviorists are right or wrong, it is certainly true that what we call character or personality is the product of action, conduct, behavior Furthermore, character is to be judged by the reactions of behavior The behavioristic school centers attention upon reactions rather than upon obscure, uncertain, so-called mental traits. The behaviorists are suspicious of introspection as a means for learning anything valuable about psychologic processes The important lesson for the teacher in the behavioristic philosophy lies in its emphasis upon the significance of *response* to *situation* as the comprehensive explanation of all development of mind and character The *test* also of moral ideas and ideals is their fruitage in right habits of conduct Instead of relying on problematic subjective traits, the teacher will do well to be more concerned with objective action, that is, with conduct If a teacher can determine a pupil's conduct, she will in that way shape the pupil's character

**Aims in character education.** In the Office of Education Bulletin (1926) No 7, entitled *Character Education* we find the objectives of character education stated as follows

1 To develop socially valuable purposes, leading in youth or early maturity to the development of life purposes

2 To develop enthusiasm for the realization of these purposes, and coupled with this enthusiasm, intelligent use of time and energy.

3 To develop the moral judgment—the ability to know what is right in any given situation.

4 To develop the moral imagination—the ability to picture vividly the good or evil consequences to self and others of any type of behavior

5 To develop all socially valuable natural capacities of the individual, and to direct the resultant abilities toward successfully fulfilling all one's moral obligations.

Investigations thus far warrant the conclusion that the prime factor in the development of any personality is the influence of

other personalities. This fact gives emphasis to the conviction that character education is a problem of community life, and that all social institutions and social agencies should share co-operatively this responsibility

At the meeting of the National Education Association in Denver the first week of July, 1935, one panel-jury discussion group devoted its attention to the topic "Education's Oldest Challenge—Character" The leader of this group was Superintendent A L Threlkeld of Denver who summarized the discussion as follows

1 Character education is a co-operative enterprise

2 It is more important to integrate character education with the school program than to teach it as a formal subject

3 Permit children to work out a code of ethics for themselves It will mean more to them than to be handed out a ready-made code

4. There are no absolute standards of character

5 The school's responsibility for character education is rapidly increasing

**Adapting means to end.** In character education the goal is the development of the socially efficient person who possesses the personal moral character that makes for social participation and social service The child is now a member of the social group of the school, he will learn to take an active and an effective part in future adult, home, church, and community life in proportion to his active participation in the school and other social life of today The objective is a self-governing, socially efficient person; this aim can be realized only through a long course of carefully directed character-training procedures carried out formally or informally in home, school, church, and community The teacher should understand the ultimate goal toward which she is working but which she really never reaches Day by day, through all the varied activities and experiences of the school, the teacher should be striving to increase, by slow degrees, here a little and there a little, the power of the child to take care of himself, to make his way in the world, to be of use to others. The most difficult of all lessons for all of us are those which

have to do with the art of living successfully These are lessons in personality adjustment and character development. All of our lives most of us try to improve ourselves, eliminate useless friction, and make ourselves more useful At the same time we instinctively desire also to work for the pleasing, genuine personal satisfactions of life It is only by means of inner achievements, through character enlargement, that life can possibly have its most significant meaning and its more enduring satisfactions

**What is right conduct?** None of us know what is right to do until we learn it We are not born with any power to distinguish right from wrong One of the greatest functions of the home, the school, the church, and the community is to teach children and young people what is right and what is wrong conduct. Today moral and social standards seem to be changing so rapidly that youth does not always find it easy to decide on the right course of action It is all a matter of knowledge, of thinking based upon adequate data of *facts* Is it right to smoke, to drink, to dance, to play cards? What is honorable and right conduct in the relations of young men and women? One thing is certain: Children and youths need an abundance of trustworthy information which they can make use of in drawing their own conclusions Moreover, here is a field where personal influence and association have an important bearing Day after day the teacher should help the children to think their way through problems of right and wrong This is really a lifelong business for the successful prosecution of which there are no definite formulae which will settle matters once and for all The duty of the school is to acquaint children with the *mores* or social standards of our day which have been found necessary in order that human society may exist at all Honesty is *more* than the "best policy," and "Thou shalt not steal" is *more* than one of the ten commandments

**Freedom vs. compulsion.** In the author's text entitled *The Country Teacher at Work* we find the following discussion on pages 18 and 19: "We are free moral agents only when the thing

we ought to do is the thing we want to do With small children the development of desirable responses through direct habituation is doubtless the only method of procedure, for a time at least But even with kindergarten children some thinking in moral situations is entirely possible The teacher should early give children a chance to choose for themselves and should provide opportunities for the making of specific moral choices. The more intelligent a teacher is and the better she understands the true nature of moral action, the more inclined she is to see to it that conduct is the result of right and proper attitudes and feelings, which always involve right thinking, also. The coarse-grained teacher or mother often resorts to force and compulsion in order to get children to conform Such methods will never prepare children for co-operating citizenship in a free democracy Coercion and force as temporary expedients are necessary, but our chief reliance should be upon the development of correct motives As a man thinketh in his heart, so is he Let us concentrate upon *right aims and ideals of action and conduct* "

**Contagion of character.** Somebody has said that character is caught rather than taught, but we know that character is both caught and taught The influence of personal association is a powerful one, but children also learn much about conduct through both direct and indirect instruction Today children are being subjected to character contagion in manifold ways For one thing, all of the people with whom they come into contact are leaving some sort of a mark upon their lives—the parents, the personalities of the church, including the Sunday school teacher, the day-school teacher, the actors in the movies; the radio personalities; characters in books, magazines, and newspapers, playmates, people on the street; the doctor, the dentist, the school nurse, and so on For better or for worse, for weal or for woe, every child is learning through varied personal associations "Personal contact and impression of character count more than all argument You find yourself responding like a vibrating chord to the note of your friend. His faith and life become the firmest ground for yours You catch his conviction,

his spirit " As William James[1] said· "Just as our courage is so often a reflex of another's courage, so our faith is apt to be, as Max Muller somewhere says, 'a faith in someone else's faith We draw new life from the heroic example "

**Power of suggestion.** Every teacher should realize that the characters of her pupils are being constantly molded for good or for evil by the various influences of the school, including, as the most powerful of all no doubt, the teacher's own personality The child is being affected constantly by the system or general conduct of the school, whether good or bad, and by the tone or spirit of the school, whether wholesome and healthful or the opposite The books, the pictures, the school furnishings, the housekeeping, all produce some effect on each child all of the time There is the direct influence of regular curricular activities of the school, of getting of assigned lessons, of reciting, and all the rest But think for a moment of the subtle indirect teachings and learnings which the teacher does not directly control The general management and discipline may be uplifting and morally beneficial or not, the teaching itself may be skillful, positive, and strong or it may lack in moral fiber and virility, the playground may help build up character or may contribute to its deterioration Every teacher should make some study of the meaning and the power of suggestion. It operates continuously, the teacher should try to make it a force for good.

**The movies and the radio.** At the present time both motion pictures and radio programs are exerting a very definite influence on the lives and characters of boys and girls We have many pictures of an educational and helpful character; we have radio broadcasts, for example, of the world's best music, as well as other excellent radio entertainment However, much that is offered in both pictures and through broadcasts is of a decidedly doubtful character and is frequently very definitely harmful Schools are now making increasing use of both motion pictures and of the radio as useful educational agencies When, for example, teachers can make use of the Yale films, Chronicles of

[1] *Talks to Teachers*, Henry Holt and Company, N Y.

America, or of the Music Appreciation Hour by Walter Damrosch, the educational advantages are clear and certain. In any consideration of character education today, the influence of both motion pictures and radio broadcasts should be emphasized. In the near future the educational aspects of these two great character-forming agencies will receive increasing attention.

**Ideas and ideals.** Dr Bagley states that "Ideals are ideas (concepts, meanings) which have a peculiar directive force over conduct because of the feeling of worth or value that attaches to them"; or, "An ideal is a master idea peculiarly directive over conduct because of its emotional coloring" Teachers and students will find it very profitable to read the last chapter in *Human Behavior* by Colvin, Bagley, and Macdonald, entitled "Character and Behavior" In all character education a teacher is necessarily concerned with the development of ideas or meanings These should be as clear and as correct as the child's level of intelligence will make possible Many of the difficulties of both children and adults in their attempts to shape and control their behavior are due to their unwillingness or their inability to face facts and get at the exact truth of any situation In all development of worthy character, ideas, ideals, and habits are the very warp and woof of the process and of the product It should be the constant aim of every teacher to help pupils to understand an ideal as clearly and as completely as possible both for its purely intellectual value and for its effect upon character In this connection the student should read the famous essay by William James entitled "The Energies of Men" in *The American Magazine*, New York City In one place he discusses Ideas Which Unlock Our Hidden Energies He says in part

> As certain objects naturally awaken love, anger, or cupidity, so certain ideas naturally awaken the energies of loyalty, courage, endurance, or devotion When these ideas are effective in any individual's life, their effect is often very great indeed They transfigure it unlocking innumerable powers, which, but for the idea, would never come into play "Fatherland", "the Flag", "the Union", "Holy Church", "the Monroe Doctrine", "Truth", "Science", "Liberty", Garibaldi's phrase "Rome or death", etc, are so many examples of

energy-releasing ideas The social nature of such phrases is an essential factor of their dynamic power

Read the entire essay Great, indeed, is the force of a truly "master idea"

**Traits of character or acts of conduct?** In the past teachers, preachers, writers, and others have been very fond of making minute analyses of personality by the enumeration and discussion of countless character traits, such as honesty, sympathy, accuracy, loyalty, and dozens of others Such a study is all well enough as far as it goes, but the fact of the matter is that this is really not the way in which character is shaped. Score cards without number have been devised for grading pupils, teachers, and others In itself, if rightly used, this practice has certain values Score cards are undoubtedly useful But children will never be changed in their moral natures by scoring them any more than they will develop skills in arithmetic through the use of diagnostic tests To develop skills, attentive, intelligent repetition is necessary; to form character, acts of conduct under control and guidance are essential To be sure, in developing both arithmetical skills and character responses or habits, clear and correct ideas and ideals of what to do, that is, of the goals of action, are of first-rate significance What a teacher needs to center her attention and effort upon are concrete acts of conduct rather than abstract traits of character For her own information, and perhaps inspiration every teacher may very well consider personality in its abstract composition, but practical character education lies in the realm of hour-to-hour responses to concrete life situations

**Developing an inferiority complex.** Dr Groves in discussing "The Inferiority Complex and Social Behavior" [1] says

If a child shows symptoms of feelings of inferiority, it is of the utmost importance that he be led away from any compensation which he may be obtaining from fancy. What he needs most is an opportunity to taste a degree of actual success The best we can do for such

[1] GROVES, E R —*Personality and Social Adjustment*, Longmans, Green, and Company 1923

a child is to give him a sense of confidence which will encourage him in his masculine protest If his feeble efforts at compensation are treated with derision or even with misunderstanding, he withdraws within himself, thinks much of his weakness, and finally falls back upon his imagination Fancy is equal to the task and can easily give him any amount of self-satisfaction if only he will withdraw himself from the actual world and give himself utterly to fiction The price he must pay for his psychic relief is the undermining of his sense of reality The child who is weak or sickly or deformed or in any way physically defective or socially handicapped is likely to be particularly sensitive to his unfortunate circumstances He is a candidate for inferiority and if no assistance is given him in his earliest efforts to emerge from his circumstances, he at least is tempted to take refuge in the fictions that will lead him toward a neurotic career Unfortunate circumstances are not inherently evil Men and women of strong character compensate for conditions that crush the weak It is the dwelling emotionally upon handicaps that makes them such a tremendous burden It is too much to expect children to recognize this fact unless they are given insight by the discerning parent or teacher.

**The laws of learning.** The student and teacher will find a discussion of the application of the laws of learning to character education in the first chapter of *The Country Teacher at Work.* It is enough to say here that the three laws as formulated by Thorndike, apply as closely and definitely to the habituation of the responses of our moral natures as in any other kind of learning The laws of readiness, of use, and of effect determine the type and the extent of acquisition in character formation just as they determine the development of ideas, ideals, attitudes, habits, skills and appreciations in reading, language, and arithmetic One of the chief duties of the teacher is to use instructional procedures so that the child will desire to learn, so that he will have the learning attitude If there is the readiness to do what needs to be done, if there is personal satisfaction in the doing, and if the conduct responses are repeated sufficiently under the stimulus of pleasurable action, then the stage is set for the forming of desirable character qualities Read, in this connection, Kilpatrick's *Foundations of Method,* Chapters XIX and XX. The author says "Habit is the unit element of char-

acter. To build character then is to build the right habits of thinking and feeling as well as of outward behaving. To this end exercise is a prime consideration. Precise practice of any trait is necessary if that trait is to be built into habit and character. It is then not sufficient that children practice merely outwardly good behavior. The inner attitude is an essential part." So far as the law of effect applies, the teacher should so set her character-learning situations and so motivate the learning responses that her pupils will be ready and willing to "practice the right with satisfaction." Then they will find that to practice the wrong will produce annoyance. All this means daily instruction, both direct and indirect. All rural teachers should read Kilpatrick's two chapters.

**Can character be taught?** Teachers should understand that they cannot make children learn anything. All that any teacher can do is to provide adequate learning situations and then bring about the needful responses through various motivating expedients. In all character education there is a large place for skillful teaching. In *An Introduction to Teaching* by Bagley and Keith we find these statements: "To stimulate, encourage, and direct learning is the soul and substance of the art of teaching. It is the pupil himself who must learn. Without activity on the pupils' part—without some dynamic expression of the *will to learn*—the efforts of the best teachers will be futile." In another place these writers say: "Thus the teacher, in place of being a taskmaster who makes arbitrary requirements and then forces the learner to meet these requirements, becomes a guide and a counselor, ever on the watch for signs that the learner is ready for this or that type of educative experience." All of this applies with especial force to the development of character traits. Any teacher whose daily program provides ample opportunity for pupils to respond in honest, courageous, reliable, accurate, attentive, and industrious ways will do much to develop the traits of honesty, courage, reliability, accuracy, attention, and industry. The traits will be developed if the teacher brings about the responses.

**Moral codes and their value.** Moral codes in great variety have been published from time to time, such, for example, as "A Moral Code for Youth" made public by *Collier's Magazine* some years ago Perhaps the best known of all the codes is the one devised by William J. Hutchins, now president of Berea College Both of these codes are printed in *The Country Teacher at Work*, and the teacher and student are here referred to the historical note on page 502 of that book Codes are undoubtedly useful in furnishing ideas of what is right in daily conduct They serve as guides to teachers and parents, but it should be well understood that even the best of codes cannot insure good conduct or go far in promoting character education The teacher should be acquainted with the best standards of conduct and should read books on this subject Many of these are listed in the bibliography at the close of the chapter referred to above None of us can do better than we know, proper ideas and ideals, as found in character codes, will do much to point the way for right conduct But, these codes can hardly do more than furnish standards and set up goals of accomplishment

**Young people's organizations.** Every rural teacher should know about the various co-operative associations for boys and girls which have been in operation, to a greater or less degree, in every state for many years These clubs are rendering an incalculable service for the youth of our land in the way of character education because they furnish the machinery for desired and desirable behavior responses In these organizations, young people are taught to co-operate, to carry responsibility, and to serve others The net result in character formation is of the greatest importance in training for effective citizenship It is only necessary to mention the Girl Reserves, Knighthood of Youth, Sunshine Club, Young Citizens League, Campfire Girls, Y. M C A, Girl Scouts, Y W C A., Junior Red Cross, Boy Scouts, and 4-H Clubs, as perhaps the most prominent organizations, to get some conception of the magnitude, the scope, and the service of these associations of young people. The rural teacher should procure a copy of a bulletin issued by The

National Education Association entitled *Agencies Contributing to Rural Education* This bulletin should be read in connection with the study of this chapter Teachers can readily learn about young people's clubs by writing to the National Office of Education or to their State Departments of Education.

**School system and school routine.** Perhaps the very best way in which a rural teacher can carry on the work of character education is by conducting a first-class school If the teacher has a carefully worked out plan and program, and if she honestly, faithfully, and sincerely does her best hour by hour for her boys and girls in conducting the regular work of the school, she is probably in this way rendering her greatest single service in character education "What a training in good citizenship is wholesome order in a well-conducted school! The knowledge gained from the curriculum is small compared with the character building resulting from a well-organized and well-administered school The daily work of the school and particularly the emotional atmosphere in and through which this work is done either lifts pupils to higher levels of moral living or else pulls them down "[1] The rural teacher needs a school organization and type of routine which will, on the one hand, be sufficiently imperative and certain in its requirements, and on the other hand, allow that freedom of choice and action so vital in true character formation.

**Moral influence of teaching procedures.** The traditional types of teaching procedures often failed in securing social co-operation Instead, the methods frequently resulted in unfavorable mental attitudes and conduct responses Too often the teaching was so crude, so formal, and so ineffective that, instead of producing the desire to learn, stubbornness and opposition often resulted Then the "master" would resort to physical punishment to "compel" learning Today this seems to us incredible in the light of our modern teaching-learning techniques by the use of which children not only learn readily and easily but also happily and with wholesome emotional reactions. The manner in which a rural teacher conducts her recitations

[1] LOWTH—*The Country Teacher at Work.*

will greatly influence the characters of her pupils. If there is only partial knowledge, with guesses at the truth, if opportunities for deceit are permitted, and if children respond indifferently and carelessly, think of the evil effects upon their characters as the farce goes on day after day Teachers who are very skillful in the use of techniques may be an influence for good Other teachers who are crude and bungling or who lack skill will not uncommonly produce conditions favorable to misconduct and the weakening of character

**Examinations—marks—reports—promotions** These words bring to an experienced teacher's mind visions of opportunities for good or for evil in character education In the better schools of today important changes in practice have been made in these four departments of a teacher's activities and duties Examinations are now much less formal and more rational, the teacher's marks are more truly representative of a pupil's status and progress, reports to parents give more than merely per cent grades in subjects, and promotions are made when a child is ready to advance The less bright children are placed where they can do the best work, all things considered Today, the better teachers in the better schools consider the welfare of the individual in all testing, marking, and promoting The inflexible procedures of the old traditional school were often anything but salutary in their effect upon the characters of developing boys and girls It is not too much to say that wrong objectives and antiquated incorrect practices in the four fields indicated in this topic are sufficient in themselves to mar a child's character for life. When we think of the unnecessary failure and sense of failure and the possible development of an inferiority complex, with all its accompaniment of futility and despair—when, in short, we contemplate the personality deterioration due to certain traditional school practices, the thought should cause any true teacher to pause and examine her own standards and practices with great care

**Rural school opportunities.** In this section the purpose is to make certain definite practical suggestions as to what a rural

teacher may do in the way of character education While these suggestions are not procedures or techniques in the technical sense, they point the way to teaching-learning activities Practically every rural teacher will today experience but little difficulty in getting an abundance of materials pertaining to character education It will pay any teacher to read the articles in both the *World Book Encyclopedia* and in *Compton's Pictured Encyclopedia*. If rural teachers could have access to the latest editions of these high-grade books, they would find many discussions of which they could make use The biographical sketches in both of these young people's encyclopedias are of real value in the way of furnishing ideas and ideals If the particular state in which the teacher is working publishes outlines of character-development procedures, these should of course be used Many state departments of education now print excellent bulletins in which complete syllabi and procedures are presented The suggestions which follow are not set down in any particular order, they are necessarily of a miscellaneous nature. Each teacher or student may select and stress the items of more special personal use and value

1 *Set a good example* The teacher, like the parent, is an example for better or for worse in any event and regardless of personal choice No sensible person expects the teacher to be perfect, but in her ways of thinking and acting, in her controlling motives, in her emotional attitudes and habits, in all of her ideas, her ideals, and her habits she is constantly a pattern for imitation. Children naturally look to the teacher for guidance Any right thinking teacher will try to make the influence of her personality as stimulating and as wholesome as possible

2 *Set learning situations* The teacher should form the habit of thinking that character attributes are acquired in the same way in which all other learnings take place It is a case of stimulus and response, situation and reaction The child learns to be honest by a long series of honest reactions in situations where there may be temptation to dishonest conduct Character habits are formed and fixed by a multitude of habituating repetitions,

just as one learns any skill by obeying the laws which apply. The teacher and student are here referred to Chapter I in *The Country Teacher at Work* and to other references listed in this book

3. *Insist on good work.* The working spirit of any school has an important bearing upon the molding of character No matter what teaching-learning procedures are used, it remains true that the business of learning cannot all be play Children must form habits of work and of working according to schedule, at least in part There are definite daily tasks to be performed in every good school, the way in which this work is done has large influence on character development The teacher who is soft and vacillating in her requirements will never do a good job in character education Every person of solid character finds that he must do a great many things which he would rather not do, just then, at any rate In the education of the school there must be regularity, promptness, industry, and loyalty to the job Children must form the work habit and the habit of doing their best

4 *Provide for success* Arrange the assignment of tasks, the allotment of projects and activities, the study and the recitation procedures, and the entire program of the school in such a way that every child does something well every day. Continual failure has a most disastrous effect on character *All* children must succeed on some level and in some way By the use of differentiated assignments even the poorest and the weakest will have something to do within the range of their abilities A good school always has an atmosphere of successful accomplishment; this must include pupils of every grade of intelligence

5 *Use the direct method judiciously* Do not forget that while children can never be preached or scolded into good behavior, it remains true that there is a most important place for the direct inculcation of ideas and ideals Much can be accomplished by judicious telling and by learning in various ways as to what constitutes good conduct The rural teacher should never give moral lectures, but she can and should give direct moral instruction

Children need information which they may get from the teacher, from books, and from other sources. William James in his *Talks to Teachers* said "Don't preach too much to your pupils or abound in good talk in the abstract. Lie in wait rather for the practical opportunities." In character building both the direct and the indirect methods need to be used constantly. Read a discussion of this problem in Ruediger's *Teaching Procedures* and in other books.

6. *Do not tolerate bad conduct.* The writer has known some rural teachers who have permitted unruly, disobedient children, mostly boys, to go on day after day doing things that the teacher knew were wrong. This is altogether bad because the child is becoming habituated more and more to wrong conduct, he becomes an evil influence in the school. Every child in the school should understand that he cannot go on with his misbehavior. The teacher must handle the situation firmly and do it very promptly. If punishment is needed, it must be administered unflinchingly. When wrong conduct is tolerated, the teacher becomes a party to the tearing down of character. If a teacher is indifferent or lacking in moral standards, the supervisor must take a hand in the affair for the good of the school.

7. *Know what is going on.* Many times the writer has visited rural schools when he was convinced that, for some reason, the teacher was apparently unconscious of some of the evil conduct of some of her pupils. It is true that certain teachers with certain types of personality are evidently unable properly to sense moral situations. These people are incompetent and should not be allowed to continue. In one way or another, and without any show of suspicion, the rural teacher should have full knowledge of the conduct of her pupils in the schoolroom and on the school grounds. A rural teacher needs good eyes and ears as well as moral judgment and moral insight.

8. *Be definite and positive.* This does not mean being a martinet or a stickler for mere form. It simply means having a program of suitable learning activities and the moral backbone to carry them out regardless of obstacles or opposition.

A successful rural teacher really needs a good deal of courage as well as patience Sometimes patience ceases to be a virtue A good teacher is firm, she is also fair and frank She is open and aboveboard in all her dealings with her pupils The children know what to expect and what the teacher will do in a given situation Definiteness and positiveness on the part of the teacher will have a salutary moral effect upon the entire school

9 *Remove unnecessary temptation* Every child should be given repeated opportunities to withstand and resist temptation, but sometimes teachers show poor judgment in permitting situations involving moral conduct to exist when there is extreme likelihood that many pupils will succumb and be guilty of wrongdoing Undue temptations to cheating in doing schoolwork should never be allowed Examinations should always be so conducted as to reduce temptation to the minimum One of the favorable aspects of many modern teaching procedures is that they make for moral conduct instead of furnishing opportunity for moral defeat Reduce lying and dishonesty to the very minimum It is not a question of punishment, it is rather a question of reducing the occasions for punishment Remember that the good qualities of our characters are developed by many repetitions of right acts of conduct In this connection read William James's famous chapter on "Habit"

10 *Be firm and also kind* A teacher does not need to be harsh in order to achieve her ends All she needs is to be persistently firm and firmly persistent She should be kind and she should also temper her justice with mercy The writer has known many successful teachers whose moral influence was unquestioned and who never found it necessary to scold, to talk in a loud tone, or to be anything but firm in a kindly way. When offenses occurred they were handled promptly. In these schools character was always in process of development

11 *Encourage effort* If a child tries to do his best, he should receive credit whether he passes or not. He has succeeded to the best of his ability and is entitled to recognition. Perhaps he would have done more and better if only the teacher had care-

fully directed the work  Often children fail, not because they are at fault, but rather because the teacher has done such a poor job of teaching  In every school the children should have the inner satisfaction of knowing that if they really try, their teacher will understand  Encourage all honest effort for its moral value, but show children how better to make their efforts count in results.

12 *You must answer this question· Is there change for the better?* That, after all, is the big question  The teacher needs to use every available agency and tool to further pupil growth and development and to discover what changes are taking place, whether good or bad  If there are evidences of deterioration, the teacher should quickly check these changes in the wrong direction  In all character education, which is a part of all the work of the school, the teacher needs to be alert to note evidences of change  Character is not built in a day, or a week, or a month, or a year, or a decade, it is really the work of a lifetime, even then some of us cannot be very proud of the job  Character education produces changes in ideas, ideals, habits, desires, appreciations, and the like, it is the business of the teacher to further all changes for the better and to reduce all changes in the other direction to the lowest point

13 *Help each child to solve his own problems*  To the child his personal problems are of the greatest importance  It helps very certainly in character guidance if the teacher can sympathize truly with each child and actually assist him in solving his problems  "I am sorry" may help, of course, but when the good neighbor said that he was sorry and then reached down into his pocket for a ten-dollar bill to show his sorrow for an unfortunate friend, it was a case of what we might call practical sympathy  The child needs very definite and continued help in solving his moral, character-development problems

14. *Guide the child in forecasting consequences*  Undoubtedly much wrongdoing and consequent character deterioration is due to the fact that the individual does not use his imagination properly and adequately in forming images of the possible effects

of certain contemplated acts of conduct It is a good thing to form the habit of counting the cost before the expenditure is made Pupils need constant practice in looking ahead to see how things will come out if they do so and so Much of evil-doing and character weakening might be avoided if only individuals had learned how to forecast events and to prepare in advance against the time of need Evil acts result in evil consequences The child must learn that lesson

15 *Teach that it pays to do right* It is not difficult to show children that right conduct usually brings its own reward In this connection make use of the world's best biography There are plenty of opportunities to demonstrate that self-control, honesty, industry, courage, and loyalty are qualities of character which make for more satisfactory and happier living in the long run Such great characters as Lincoln, Pasteur, Madame Curie, Edison, Horace Mann, Mary Lyon, Emma Willard, Alice Freeman Palmer, and many others clearly prove the value of moral character, associated as it often is with the purely intellectual achievements

16 *Develop the suspended judgment.* There are opportunities every day in every school for children to learn the lesson that it is always unwise to jump at conclusions based on insufficient data of facts In moral situations much damage may be done to oneself and to others by hasty generalizations. The *habit* of waiting until at least more evidence is in, when it is needed, is a good one to form In character education it is important that the techniques of sound thinking be used in solving problems involving moral questions and values The moral judgment is never completely formed. Pupils need repeated opportunity to use their moral judgments with the greatest care and with a spirit of tolerance.

17 *Clear up confusions* A good way to weaken a child's character is to permit him to go on day after day without getting his lessons or without comprehending what he is trying to learn It is the very plain duty of the teacher to clear up misunderstandings and to help the child to comprehend his lesson mate-

rials, no matter how long it may take or how much trouble it may be. Mental confusion does not contribute to normal character reactions The tragedy is that so many pupils go on day after day with partially prepared work until they finally get the settled conviction that they cannot understand anything or do any work very well That is a demoralizing state of mind

18 *Discuss practical character problems* If a teacher will take pains to consider certain moral situations with her pupils in group meetings in a purely impersonal, objective way, showing pupils how to think out their conclusions, such practice will prove of real value as one means of character guidance Often the occasion will develop from a reading, a history, or a geography lesson; a wise teacher can render a genuine service in this way if she will carefully refrain from moralizing and if she will always see to it that the whole exercise is conducted with the utmost tolerance and spirit of fair play.

19 *Stress objective attitudes* Teachers should aim to avoid the development of undue self-consciousness Children must become neither priggish nor abnormally introspective. In all efforts to help the child to change his ideas, his ideals, and his habits it is well to attack personal problems which arise with as much objectivity as possible There are decided elements of risk in an overdevelopment of the subjective attitude. The healthy, wholesome, normal mental outlook is one in which character problems are approached somewhat as we study any impersonal, purely objective problems Early in life the child needs to learn the lesson of careful, impartial consideration of all problems, personal and impersonal, with a view to solving them on the basis of factual evidence

20 *Make the most of the natural character-forming situations of the school* In a rural school there are many daily opportunities for profitable character-forming activities In the use of problems and projects in practical civics and citizenship, in conducting a program of thrift enterprises, in the school society, in a system of pupil committees, in a truly socialized recitation, in general exercises, in supervised play, in health activities, in

the work of the social studies, in private interviews, in well-conducted class conferences, in a rational program of directed study, in the profitable use of the library, in the observance of special days, in a well-planned study of great personalities, in the use of various forms of creative expression, in the reading and language classes, in making use of excursions, and in many other ways the competent rural teacher will be able from hour to hour to shape the lives of the growing boys and girls

21 *Develop a spirit of fair-mindedness* It is of the greatest importance that children early in life learn the lesson of charitable tolerance of the views and the ways of life of other people It is so easy to form the habit of blaming others and of not being willing to get the other person's point of view It is well to be objectively critical and to be careful in weighing evidence, but when other people are involved some sympathetic consideration of their inherent rights is always in order In the regular conduct of the daily classes a teacher needs to be mindful of the mental attitudes which children are often unconsciously forming A spirit of fairness, of fair play, is a mental attitude which should characterize the type of thinking developed and promoted by our schools

22 *Certain habits are basic and desirable* It is not possible for a teacher to teach character in set lessons and in a formal way as she often teaches, or tries to teach, so many school subjects It may be that formal methods will work to some extent in arithmetic, spelling, and other subjects, but character is not learned in any such way Character education is going on constantly from moment to moment If a teacher insists upon the habit of orderliness, of keeping personal and school property in good order, of taking good care of all property, of thinking before speaking, of speaking clearly and in low courteous tones, of seeing things straight as they really are, of working in systematic ways, of giving respectful and thoughtful attention—if a teacher can develop these habits without nagging or scolding she will render a genuine service Such habits as those of labeling things, of writing good headings in the various subjects and

lessons, of preparing neat papers in proper form, of completing well work once begun, of reading for meanings, of doing one's best, of using the sense of responsibility, and of thoughtfulness and carefulness in general—such habits will go far to integrate and solidify a much needed type of American character.

23. *Teach pupils to profit by mistakes.* An honest mistake is a good thing as a means of learning. Children should understand that certain types of errors in conduct are inexcusable or may often have disastrous personal effects. Of course mistakes of all kinds should be reduced to the minimum because they are so wasteful of time and effort; children need to learn by their mistakes so that they will not be making the same ones over and over again. Mistakes and errors should not be a cause of discouragement or of remission of effort; children should be taught to correct their errors in schoolwork or in conduct and to go right on with the least possible delay. Teach pupils to make careful plans, to forecast their needs, and to avoid mistakes as much as possible by careful thinking and by imaging of consequences. Pupils need to learn the lesson that in the building of character it is usually better to remember in time and thus to head off troubles due to forgetting.

24. *Merely talking is quite futile.* It is very easy for the teacher to talk too much, to give too much advice, to say "don't do this" and "don't do that," to moralize, to scold, or to admonish children unduly. It is distinctly not so much the teacher's talk that is needed, it is rather the pupil's activity that really counts. It is the teacher's business to set the scene and to guide and stimulate the child in his efforts to learn the lessons in character. The best teachers are those who provide adequate learning situations and then quietly but persistently see to it that the child responds to the best of his ability. Talk less and teach more is good advice for many teachers. It will often be better to arrange to have the pupil get his ideas and ideals from good books. In character education a teacher should continually be giving children an opportunity to come into contact with great characters through the world's best literature. Let the

strong and noble personality make its impress upon the child's soul through the agency of the classic legend, or story, or other masterpiece The teacher needs merely to make the introduction

25 *Guessing at the truth is a bad habit* The teacher will find that the more she can develop a respect for facts and a reverence for truth, the more successful will her other efforts become in the general program of character education The writer used to feel that he did a real job of character education in his geometry classes When a high-school student has really learned to demonstrate a proposition so that he knows he has proved the theorem, he will then have a higher conception and appreciation of all exact knowledge, and moreover, there will be a certain "carry-over" to moral values

26 *What is right here and now?* It is not so much a question of abstract duty or of remote ideals not well understood, but rather a problem of what to do in particular circumstances In all character education, the more specific, direct, and concrete the teacher can be, the better for the child Ideas of abstract duty are indefinite and do not impel the child to action The most successful program in building character is one which involves specific responses to specific moral situations All general moralizing and abstract appeals to right conduct are usually unavailing and may actually do harm despite the best of intentions "Every school at work, in the most intelligent way possible, upon its everyday problems is the ideal in mind" "Character education built upon the integration of values in the day-by-day choices of pupils as they meet their major life situations will, of course, permeate the whole curriculum"

## REVIEW, TEST, AND PROBLEM EXERCISES

1 Make out a trustworthy and useful bibliography for the rural teacher on the subject of character education—twenty-five references.

2 Prepare a ten-minute talk on some phase of character education and present this talk in class or assembly

3. Make out a questionnaire of twenty-five items, the correct answers to which will disclose important personality characteristics of a grade child.

4 Make out a 100-item objective test on this chapter, using four types of such tests

5 Show how the health and character education programs may mutually supplement and reinforce each other in a typical rural school

6. Make out twenty-five personal problem questions based on this chapter.

## REFERENCES FOR THE TEACHER'S READING AND STUDY

1 *Compton's Pictured Encyclopedia,* F. E Compton Company, Chicago, 1935 (This beautiful and instructive set of books contains many articles and stories pertaining to character building)
2. GERMANE, C E, AND GERMANE, EDITH G —*Character Education,* Silver, Burdett and Company 1929
3. KILPATRICK, W H —*Foundations of Method,* Chapters 19 and 20, The Macmillan Company 1925
4 *Report of Committee of National Education Association, Department of Superintendence*—Tenth Year Book, 1932 Character Education
5 *Report of N. E. A. Committee, 1926*—Education Bulletin 7—Character Education—Superintendent of Documents 15¢
6 *Research Bulletin of the N E A* —Education for Character, Part II, Improving the School Program, May, 1934 64 pp 25¢
7. *World Book Encyclopedia,* W F Quarrie and Company. Chicago, 1935 (Read article on "Character Training" and note the cross references at end of article)

Investigate the Young People's Organizations mentioned in one topic Write to the Office of Education and to your State Department of Education In many states a special state program of character education is now being successfully conducted, and instructive and useful circulars and bulletins are published by State Departments of Education.

# CHAPTER XXIV

## HEALTH ACTIVITIES IN THE RURAL SCHOOL

**Purpose of this chapter.** In the first edition of this book Chapter X was entitled The Health of the Pupil. The discussions were chiefly concerned with the physical welfare of the child, and such topics as Tests of Hearing and Sight, Suspicious Symptoms, Undernourished Children, Children's Teeth, Adenoids and Tonsils, Value of Milk, and similar matters were given considerable attention. In this chapter, which stresses health *activities*, the author has a somewhat different point of view as well as a different purpose, in keeping with the general nature of the second part of this text, which treats of the problems of teaching and learning. The central interest and concern in this chapter are teaching and learning health through the use of a variety of procedures. The child's health is determined largely by his knowing what is right to do and by his actually doing the right things habitually because of a real desire to do them. He will neither *know* nor *do* unless he is interested. Health activities must therefore be well motivated. A program which consists in the learning and reciting of textbook materials will seldom secure the desired results in healthful living. The new objective is found in the nature of the teaching and learning processes. The child learns the ways of healthful living by his responses to health situations. The function of the teacher and the school is to furnish daily health situations, the pupil responses to which will develop ideas, ideals, and habits that make for health. *Active response is an absolute essential.*

**General aims of health education.** The aims of health education as stated in *Health Education—A Program for Public Schools and Teacher-Training Institutions*, the report of the Joint Committee on Health Problems in Education of the National Educa-

tion Association and the American Medical Association, 1930 (second edition), are as follows.

1 To instruct children and youth so that they may conserve and improve their own health

2 To establish in them the habits and principles of living which throughout their school life, and in later years, will assure that abundant vigor and vitality which provide the basis for the greatest possible happiness and service in personal, family, and community life

3. To influence parents and other adults, through the health education program for children, to better habits and attitudes, so that the school may become an effective agency for the promotion of the social aspects of health education in the family and community as well as in the school itself

4. To improve the individual and community life of the future, to insure a better second generation, and a still better third generation, a healthier and fitter nation and race

In a bulletin published by the Health Education Department of Rochester, New York, health objectives are stated as follows.

1. To conserve and improve physical fitness for life activities through a program of exercise, rest, and nutrition

2 To develop right attitudes and ideals relating to all phases of individual and community health

3 To make desirable health habits automatic through emphasis and practice

4 To seek correlations with other fields of school activity in the interests of child health

**Health standards for schools.**[1] Every pupil on leaving the elementary school should be as carefully trained in the fundamental habits of health as in the three R's Without the former the others are of little value

The real test of health education in the schools is in the health of the children If there were excellent classroom teaching of health from the kindergarten to the high school, properly supported by co-ordinated activities of school physician, school nurse, parents, teachers, and all others playing a part in the

[1] The statements in this topic are found in a bulletin issued by the Office of Education, Department of the Interior, and entitled *Suggestions for a Program for Health Teaching in the Elementary Schools* It may be secured from the Superintendent of Documents for ten cents

training of children, what ought we to expect? It is difficult to say, because the experiment has never been tried consecutively for eight or nine years with the same children Some day the time will come when the great majority of children, possibly 80 or 90 per cent of them, will reach a standard something like this:

1 All children well nourished, none more than 10 per cent below the required standard of weight according to height and age
2. Habits of personal cleanliness established
3 Good bodily resistance
4. Freedom from physical defects secured
5 Good sitting, standing, and walking postures
6 All teeth kept clean
7 Permanent teeth all present and in good condition.
8 Daily recreation in the open air
9 Habit of daily evacuation of the bowels.
10 Practical health knowledge that works
11 A sense of buoyant physical well-being
12 Partnership in the solution of school, home, and community problems in health

This goal may seem Utopian, but it is just as practicable and possible as it is to apply the scientific rules of agriculture and grow 125 bushels of corn from an acre of land that formerly produced only 40 bushels A few have dabbled with the health education of children, but they have done very little along the lines of a co-ordinated and scientific program for the health education of the school child Utopian as our goal may seem, many practical people have the vision and are dedicating their lives to its realization

**Physical deficiencies of rural children.** Children in rural schools are certainly not essentially different from boys and girls in town schools, but the health of urban children is receiving much more attention This is clearly not a square deal, as the health of growing children is a subject of national concern, the very success of our democracy and society in general, as well as the welfare of the individual and of the family, demands that this subject be given continued and increased attention The eyes, ears, and teeth of children in country schools are often

defective. There is blurring of vision, near- and far-sightedness, and astigmatism There, for example, was the twelve-year-old boy, so deaf that he could not hear ordinary conversation and whose eyes were so weak that he was obliged to hold his book within a few inches of his face Notwithstanding his condition neither teacher nor parents had done anything about it, although the defects had existed for several years In the same school a little eight-year-old girl had been unable to walk one morning A paralysis of some sort affected her legs so that she was at least temporarily crippled What was the cause? All bodily defects have a cause which it is the duty of teacher, parents, and county nurse to get at, if possible, with the aid of a scientific physician Sometimes we find a child with running ears, a very serious condition, and it is common to find partial deafness due to infections from colds

Many rural pupils suffer from toothache; their teeth have in many cases never received the attention of a dentist. Some parents think that it doesn't matter about children's first teeth—a not unusual but a serious error Malnutrition is exceedingly common even where food is abundant, pale, weak, anemic children are to be seen practically in every rural school Because of ill-fitting seats and desks, and for other reasons, spinal curvature, resulting in life-long troubles unless corrected, is all too common Cases of diseased tonsils and adenoids are sure to be found if teacher and nurse make the proper examination Every intelligent teacher should know the disastrous effects of neglected tonsils or adenoids Children often complain of headaches day after day—headaches due to nervousness, to the absorption of poisons, or to improper diet. Nervous troubles are often present, but they are not so easy to detect Speech defects prevail in nearly every good-sized school Last, but by no means least, is the dread tuberculosis, which often gains headway without the knowledge of parent or teacher, who should be posted on the early danger signals and secure a medical examination before it is too late This is only a partial list of common defects, but it is enough to show the seriousness of the situation.

**Precautionary and remedial work.** No rural teacher is doing her duty unless she makes a complete health survey of her school through the examination of individual children She can find books which will tell her exactly how to do this, the county health nurse or some competent physician will aid her The health of pupils is the first and most important concern of every rural teacher The first month should not go by without finding out the chief physical defects, if any, of each child This information should be set down on cards for future reference School time should be taken to find out about eyes, ears, adenoids, and all else The teacher will need to secure the coöperation of parents in certain cases, when possible, and it is often possible if the teacher uses good judgment in her tactics. Many parents are woefully negligent in such matters, the teacher must use tact, common sense, and caution Many children will need to be taken to a good, conscientious doctor, perhaps to an ear, eye, nose, and throat specialist and to a dentist Try your best to see that the child gets expert service before it is too late It often happens that wrong personal habits and wrong home practices are at the bottom of the trouble Some children will improve if they sleep longer and with their windows open Some need to drink several glasses of milk every day, and some are not eating enough of other good food Every rural school child should drink at least a quart of high-quality whole milk every day. Others are eating too much of sweets, such as candy, cake, pies, and cookies Many a child will improve in health if his teeth are put in good condition It has often happened that a child's whole outlook upon life has changed when his eyes have been fitted to a suitable pair of glasses, the tragedy is that so many children live on year after year suffering unduly and unnecessarily from defects which may readily be remedied

**Limitations and opportunities of the rural situation.** Undoubtedly the rural environment is not always and altogether conducive to good health, although many people apparently think of the country as always a very healthy place in which to live Conditions vary greatly in different states and in different

sections of each state In some rural communities attention has been given to the subject of health and the efforts of the people in this direction have produced results However, it is very likely true, even today after all the years of agitation and spreading of information and with the co-operation of many health-promoting agencies, that both the average rural dwelling house and the average rural school building at the present time are sadly lacking in the essentials for healthful living To be sure, there is plenty of fresh air and often of sunshine out of doors, but these life-giving health requisites may not be found in many homes and schools Homes and schools are often poorly ventilated; the lack of window space or improper use of curtains may shut out the sunlight It is also true, of course, that millions of city dwellers live in places entirely unfit for human habitation Just now there seems to be some prospect that such evil conditions for some tens of thousands of town dwellers may be greatly improved in the near future

The rural situation is often worse than it needs to be There are opportunities for improvement Most of all are needed ideas plus ideals plus the necessary effort Leadership is often conspicuously lacking Certainly some money will also be needed; but even when funds have been available, little has been done because of a lack of the necessary knowledge or of the desire or ambition to make a change A rural teacher who has the proper information, or the desire to get it, and who is enthusiastic for health improvement can do very much to change conditions. If this teacher has a strong and influencing personality results will be forthcoming The writer has seen rural teachers clean up dirty buildings and outbuildings, keep the schoolroom air in much better condition, let in all possible light, have plenty of fresh, pure water, overcome malnutrition by the use of the hot lunch, more milk, and in other ways, secure the co-operation of the county nurse and of the mothers, and make a physical survey There are plenty of rural-school limitations certainly, but there are also opportunities for improvement in every school if the teacher will only take advantage of them She

certainly needs and should have the co-operation of the parents, taxpayers, board members, county superintendent, county nurse, and perhaps of the state board of health.

**Making a preliminary health survey.** For a more complete survey outline than there is room for here the student and teacher are referred to an article in *Hygeia* for June, 1931. The title is "The Rural Teacher's Opportunity"; the discussion deals with rural school conditions and what the teacher can do to improve such conditions. The concluding part of the article is a survey outline which is taken from the monthly bulletin of the Michigan Department, or Board, of Health. The four general divisions of this outline are Health Environment, Health Status of Children, Health Habits of Children, and Personal Qualities of Teacher. Under the first division the survey questions cover the subjects of water supply, toilets, windows and lighting, ventilation, cleanliness, temperature, and seating. The student or teacher will find this outline very useful. Every rural teacher should have such a guide or checking list of essential matters for ready reference at all times.

The rural teacher needs some means which she can use several times during the year to discover vital facts about a child's condition and habits, in order to ascertain if any gains are being made and to determine remedial measures in individual cases. The following thirty-four questions, arranged in miscellaneous order, will assist the teacher in getting at some of the most essential facts. First set down the name, age, and grade of the child, and the date. Then get answers to (1) Do you sleep with your window at least partly open? (2) When do you usually go to bed and when do you get up? (3) Do you sleep well or do you wake up a good deal? (4) Do you always eat a good breakfast? (5) What do you usually have for breakfast? (6) Do you drink coffee or tea? If so, how much? (7) What contagious diseases have you had? (8) Have you ever been vaccinated? (9) Have you ever been given antitoxin for diphtheria? Have you been inoculated with the Schick Test? (10) Do you have toothache? (11) When were you taken to the dentist last? What did the

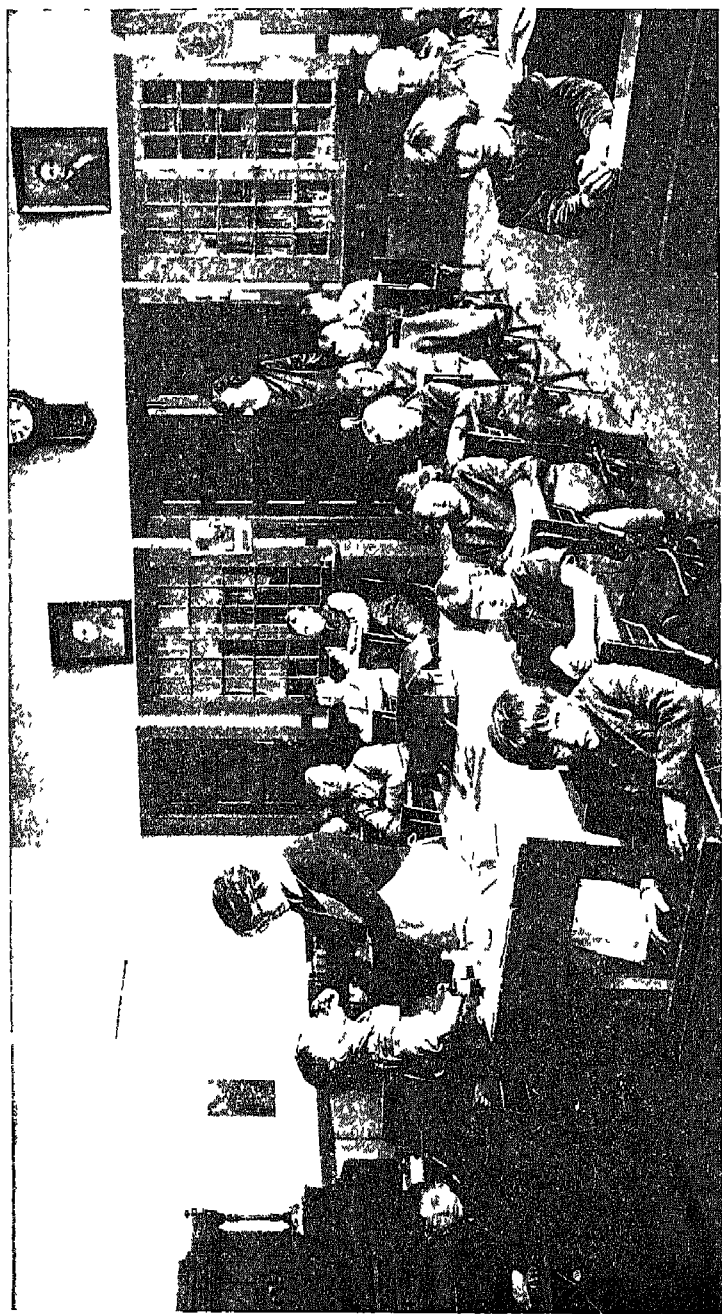
dentist do? (12) Are you hungry for dinner? (13) What do you usually eat for dinner? For supper? (14) Do you eat much candy, cakes, cookies, and the like? (15) Have you a good toothbrush, and do you use it every day? (16) How often do you take a hot bath with plenty of water and soap? (17) Have you ever been troubled with earache? (18) Did your ears ever run, and if so for how long? (19) Can you hear well? (20) Do your eyes ever bother you? How? (21) When you read does the print sometimes look blurry or hazy? (22) Does your head ever ache and feel hot and dull? (23) Do you have sore throat very much? (24) Do you feel like working in school or not? (25) Do you like to play out of doors? (26) How much water do you drink with your meals and during the day? (27) Do you work at home? How much, and at what kind of work? (28) Can you hear readily what the teacher and children say in school? (29) Can you easily read what is on the blackboard from your seat? (30) When did you go to the doctor last? (31) Do you drink at least a quart of milk every day? (32) Do you always wash your hands before eating? (33) Do you feel rested when you get up in the morning? (34) Name the different kinds of food which you have eaten the past two weeks

In addition to these answers, which the teacher must, of course, obtain with a great deal of tact and discretion, it will be of value for her to note on the pupil's health card also, the following facts, some of which are cited in *The Classroom Teacher*, by Strayer and Engelhardt [1] (1) Does the pupil have difficulty in respiration? (2) Has the pupil speech impediment? (3) Is this child sick often? (4) Does the pupil appear healthy? (5) Has the pupil cleanly habits? (6) Is the child's head free from vermin? (7) Is the child's tongue coated? (8) Is the child active or sluggish? (9) Does this pupil wear glasses? (10) Does the child show any such eye defects as redness or watering of the eyes, squinting, frowning, cross-eyes, holding book too near, miscalling well-known words, and the like? (11) Has the pupil good

[1] STRAYER, G D, AND ENGELHARDT, N L—*The Classroom Teacher*, American Book Company 1920

teeth? (12) Are his hands and face clean? (13) Are his clothes neat and clean? (14) Does the child have a handkerchief and does he use it?

The rural teacher should form the habit of recording various data regarding the physical condition of each child from time to time Such a record is as important as any record of achievement in school subjects Each child should have a good-sized card on which are recorded all facts pertaining to the health and the defects of the individual. When a child is absent because of sickness the record should be made in sufficient detail

**Need for periodical health examinations** Some day every school child in America, in both town and country, will be given a thorough physical examination at the beginning of his school life and at regular and frequent intervals thereafter We are a very long way at the present time from a realization of such a desirable program, but the time will come when this procedure will be taken as a matter of course, as it now is in some favored school systems The teacher and the school nurse can make many tests and discover many facts concerning the physical condition of the child, such as weight and height records, data concerning health habits, and other needed information, but a trained and skillful physician is required to make examinations of heart, lungs, throat, blood, and urine and to give the other usual tests in a complete physical examination The physician discovers foci of infection and evidences of malnutrition He makes tests of the nervous system and he notes evidences of nervousness and lack of emotional balance A well-qualified physician today is able to learn much about a child's mental health as well as his bodily conditions It is certainly quite as desirable to know about a child's mental status as his physical, the two conditions are very closely related An ounce of prevention is worth a great deal of cure, there is preventive psychiatry as well as preventive medicine In one school system (San Diego, California), "a system of physical and medical examinations is applied at the first, fourth, seventh, and tenth grade levels" "Developmental difficulties are located early in

**County nurse visits a rural school**

This is one means of promoting the health of rural school children

life and a health history of each pupil is carried forward to accompany his scholarship record." "Special examinations supplement the routine examinations in accordance with individual need, and the correction or treatment of difficulties is encouraged through a system of reporting and conference with parents." On this subject of health examinations teacher and student are here referred to the *Health and Growth Series* (3 or 6 books), published by The Macmillan Company. These books are written in a style which appeals to children and the resulting interest and enthusiasm prompts the child to make an effort in forming needed health habits. The teacher will find the manuals which accompany the series of very great aid in teaching. In the different books several pages are devoted to the nature of health examinations.

**A comprehensive and adequate program.** To show what can be done in a modern progressive school system, we quote[1] from an article in the *Journal of Education* for January 6, 1936, by Superintendent Will C. Crawford of San Diego, California.

Physical welfare and health development receive an emphasis coordinate with the social and intellectual phases in the program of the San Diego schools. A well-developed health department with medical, dental, and nursing staff is provided, which is charged with responsibility for health protection, health education, and health development throughout the school system.

In addition to the usual health-inspection service, special attention is being given by the department to a program of health instruction. Health knowledge and health habits on the part of children are encouraged by nurses and staff members through classroom talks, personal conferences, school assemblies, and special classes in home nursing and first aid. Motion pictures, posters, and health-instruction materials are made available by the department to teachers, parent-teacher groups, community agencies, and to student clubs and organizations both in school and out.

Great emphasis is placed upon home contacts. Local experience has shown that illness of pupil or family is the cause of 75 per cent of all absence in the elementary school, hence nurses call upon all second-day absentees and become the first contact between school and home in all cases of absence. Cases are referred by the nurse to attendance

[1] By permission of the *Journal of Education*.

workers or visiting teachers only when complicating factors are involved As a result of the constant visiting in homes for attendance or advisory purposes, the nurse has become a familiar, and in most cases, a welcome visitor in every district and has paved the way for a co-operative and constructive health program

The prevention and lessening of child-malnutrition conditions growing out of the depression has been an important phase of the department's activities and has resulted in numerous home contacts which have led to helpful discussion with parents regarding simple nutritious diets, mental hygiene difficulties, or physical defects which deplete children's vitality Through co-operative contact with family welfare agencies, nurses have been able to secure adjustment of the diets of children under agency care, and have provided many malnourished children with milk, orange juice, or lunches at school

Through co-operative relations established with the Board of Health, the medical profession, and the P T A , effective immunization and vaccination programs have been carried out yearly on a free or part-pay basis, traveling dental clinics have been established from time to time, and free medical and optical clinics have been developed which have contributed to the normal development of innumerable children during the past few years

School children everywhere are greatly in need of just such a program of health In rural communities particularly the need today for a much more comprehensive and adequate health program than is now found is one of the most conspicuous examples of the contrast between what is possible and what is accomplished It takes money and leadership to give rural children a square deal in the promotion of individual health, but our national welfare demands that these essentials be forthcoming

**Individual differences in health instruction.** Individual health training through all the grades is vastly more important than any crystallized course of study The health instruction and training most valuable for any boy or girl depend on the needs of the individual. The girl with bad posture needs personal help A boy much underweight may need suggestions on taking more rest rather than doing strenuous work in a gymnasium If we could deal with each child according to his needs from the kindergarten through the high school, we might expect to get a product in health at the end of his school life to be proud of This principle of instruction should be the care of the

health work through all the grades Every teacher and parent is hereby warned against accepting the most perfectly worked out course of study in health teaching in place of attention to the individual needs of the individual child [1]

Provision is made for individual differences in (*a*) range of information and activities, (*b*) drill in habit formation for the duller pupils, (*c*) scientific explanations and advanced projects for the gifted groups, and (*d*) self-testing and checking devices Work is provided not only for those of the average ability of the grade but also for the exceptionally dull and the exceptionally able

If there are children in the class so far below average in intelligence that they cannot grasp the theory underlying healthful living, they should be taught specific healthful ways of acting in many concrete situations The repetition of the fundamental health habits provided in the series is admirably suited to this group For example, the repetition of exercises in planning meals gives the children in the lower ranges of intelligence opportunity to master this subject The teacher should not be disturbed if the less gifted children do not master all the facts in their texts It is the right of every such child to have work suited to his capacity—work in which he can succeed If he acquires the essential health habits and a knowledge of where to seek advice concerning health problems, the teacher should be well satisfied The brighter children in the class can master the more technical parts of the text and can also do independent supplementary reading The texts provide a variety of material from which the teacher may select that which is best suited to the needs of individual pupils [2]

**Thinking and doing in health situations.** We cannot escape the necessity of reacting in some way to health situations for they are constantly arising From the time we awake in the morning until we go to sleep at night there is a constant succession of behavior responses of some sort Luckily for most of us, habit in most cases takes care of what we think and what we do We are fortunate, indeed, if we have a good set of physical and mental habits, those habits which make for mental and physical health and wholesomeness Often this is not true, as we can all testify William James said that "The hell to be endured hereafter, of which theology tells us, is no worse than the hell we

[1] United States Office of Education—*Suggestion for a Program for Health Teaching in the Elementary Schools*

[2] Charters, W W, Smiley, D F, and Strang, Ruth M—*The Health and Growth Series*—(Teacher's Guide), The Macmillan Company 1935

make for ourselves in this world by habitually fashioning our characters in the wrong way Could the young but realize how soon they will become mere walking bundles of habits, they would give more heed to their conduct while in the plastic state We are spinning our own fates, good or evil, and never to be undone " [1] Dr James was thinking particularly of moral habits, but the same statements will also apply to health habits Bad physical habits cause a vast amount of suffering and disease The school, the home, and other educational agencies have a large responsibility in helping children and young people to form good habits of body and mind

Thinking right does not necessarily imply that anyone will do right in a given set of circumstances "If to do were as easy as to know what were good to do," said Portia, then "chapels had been churches, and poor men's cottages princes' palaces " But it is one thing to *know* and a much harder thing to *act* If we have the habit of chewing our food well, of drinking enough water and milk each day, or of sitting straight and standing erect, then we shall do these things automatically without the necessity of thinking Sometimes we must pass judgment in a given health situation, one of the functions of the school is to teach the child to make inferences or draw conclusions Shall I go skating this cold, raw evening even though I have not fully recovered my strength from an attack of the flu? Good judgment says that I had better wait a few days Shall I take a second helping of this rich food? Although urged to do so, previous experience tells me that I had better not In health instruction, the child should be taught both to think and to do Good habits should take care of most of our health conduct, but some problem solving is also required of everybody It is undoubtedly true that many, if not most, people do very little real thinking in relation to problems of health The condition of their bodies is almost wholly determined by their habits, some of which are no doubt good and others of a character to give trouble, sooner or later

[1] JAMES, WILLIAM—*Psychology*, Henry Holt and Company

**Relative ineffectiveness of most health instruction.** The writer has a clear memory of the type of physiology lessons which he had in both the elementary and the secondary schools They were purely bookish and academic in character, with almost no influence upon the health improvement of any pupil There were textbook assignments of so many pages and formal recitation activities consisting mainly of question-answer, reproductive responses of textual materials There was much anatomy and physiology that did not function Physiology charts were used and large colored plates gave misleading notions of the human body and its organs Pictures showing the effects of alcohol were common and grotesquely exaggerated So far as discoverable, these views had no particular effect on a desire to live a normal, healthful life Most of the health instruction even at the present time is of little avail Relatively few teachers understand the fundamental need for fixing health habits; moreover, the techniques for the development of such habits are usually lacking In the majority of schools teachers do not succeed in producing a genuine, motivating desire for good health Real interest is not aroused, and wholesome mental attitudes are not given much attention Too often health information is in the form of fragmentary near-truths or near-facts To make health instruction more effective there must be a radical change of objectives and of procedures Children must become objectively health conscious, without the evil accompaniment of undue introspective self-consciousness

**What is the best time for teaching health?** The teaching and learning of health should not be thought of as a formal procedure at all Probably the most fruitful health activities will be quite informal, indirect, and incidental. The main requirement is a teacher who is wholesomely health-conscious herself, who has correct up-to-date information, or knows where to get it, and who realizes the enormous importance of habituation activities and exercises The best teachers of health are vigilant and watchful for opportunities to make real in the lives of their pupils the essential truths and practices of healthful living It is

doubtful if formal recitations should ever be used There must be opportunities for group discussions, for purposeful reading, for well-directed study, for a variety of sensible testing procedures, but no time should be set aside for unthinking reproduction of textual materials Teachers should make use of the best modern textbooks and workbooks They should utilize some of the now abundant teaching materials Pictures and posters are valuable There are now many sources of bulletins, pamphlets, and other forms of teaching aids The first book to secure is *Health Education*, which may be obtained from the National Education Association Other sources of information are listed in the Appendix of this book The *World Book Encyclopedia* and *Compton's Pictured Encyclopedia* are valuable reference books What is the best time to teach health? The answer is *any time* and *all the time*, directly and indirectly, every day, during all the years of a child's school life

**Some teaching-learning principles in health education.** We are gradually coming to understand that health is something to teach and to learn Children must acquire accurate knowledge, they must come into possession of correct scientific information, which means that they understand and know the needful facts or ideas But ideals, attitudes, habits, and skills are also essential and of vital importance Now, ideas, ideals, and habits of health can be taught and learned as in any other field of human learning This teaching and learning should not be a hit-or-miss process, it need not be if the teacher understands the underlying principles Below are presented several of the well-recognized laws of learning of which the successful teacher makes daily, though indeed often unconscious, use The laws of readiness, effect, and use have special application in the learning of health ideas, ideals, and habits The laws of readiness and of effect are often ignored, and the repetition is often purposeless and mechanical See the chapter on How We Learn and other chapters in this book which treat of teaching and learning procedures

In order to make this discussion of teaching-learning prin-

ciples and procedures as applied to health education more definite, specific, and concrete, the various suggestions are here given in the form of pedagogical imperatives:[1]

1 *Make sure that the response to any health situation is associated with pleasing conditions and circumstances* Habits of good health cannot be acquired by force or by mere repetition Repetitions must be made interesting and attractive Scolding and nagging do not secure results, their effects are negative or worse

2 *Stress the fact that those fundamentally important habits which are connected with eating, sleeping, and the elimination of wastes must be started and fixed very early in life* These habits have a direct bearing upon efficiency, successful living, and happiness throughout life The most that the school can do is to teach correct ideas and ideals in these highly significant matters, but, in connection with the noonday meal at school, something may be done directly to establish good eating habits, at least

3. *Do not pay too much attention to misconduct, for the child may get real satisfaction and pleasure from the attention which he receives when he is violating the rules of health* Here is a good place to ignore certain types of disobedience and to depend rather upon the building up of enthusiastic desire for something better through positive, objective teaching of what is right

4 *Remember that the best form of approval is that which is spontaneous and natural* It is right and even necessary that the child should know when his conduct is entitled to the praise of teacher or parent, but the danger lies in formal, more or less artificial commendation Sometimes words are superfluous, the manner and facial expression constitute a sufficient reward In any case the child must take pride in well-doing and in overcoming deficiencies.

[1] Many of these suggestions are found in *Health Education—a Program for Public Schools*, to which the author is indebted Suggested ideas only have been utilized using different phraseology

5 *See to it that children have a chance to try and to experiment even though they make mistakes* Skills are acquired only by independent individual trying and practice Teachers and parents often rob the child of a chance to learn by experience All health habits that have to do with eating, dressing, exercising, and posture must be acquired by a process of trial and error or success, to a greater or less degree A child learns through his mistakes and he is entitled to make them if they lead to ultimate success

6. *Try to make the school as favorable an environment as possible* Good health habits are often the result of imitation If parents and teachers are bad examples, the child is sure to suffer the consequences Scolding is futile at any time, but more particularly when the personal and social standards of the environment conflict with correct ideals of health conduct Example is stronger than precept in the realm of health habits, as it is in morals

7 *Be certain that any show of anger or other emotion on the part of the teacher when the child does wrong is fatal in its effect* When the teacher manifests any emotional excitement as the result of a child's misdemeanors, he is only adding fuel to the fire Calm, dispassionate treatment of the offender produces the best results In all teaching-learning processes the emotional accompaniment is a large factor, and has a direct bearing upon the net learning product Every child has a right to a just and fair consideration of all the modifying influences He may be right or wrong, or partly right and partly wrong

8 *You should know that the average child responds best when he sees that there is a good reason for such a response* Abstract reasons do not count The explanation must appeal to the child on his own level of understanding and experience Relate reasons and explanations to what the child naturally needs and desires, always trying to change the child's desires to correspond to his real needs.

9 *Do not depend very much upon negative suggestions* The best results are obtained by an objective emphasis upon a pro-

gram of desirable goals and activities. Restraint and prohibition in health, as in character, do not accomplish as much as attention to the worth-while, positive, and possible achievements

10. *Take easy steps as a rule in the forming of habits* A little today and a little more tomorrow is the best way No boy learned to skate or to swim well in a day In forming any health habit the most important thing is persistence and the allowing of no exceptions Any child may learn to eat a food he does not like if he takes only very small amounts and keeps on trying

11 *Emphasize successes and not failures* Do not expect too much of children at any time Be satisfied with small gains just so long as some progress is being made. Children are sure to forget and to go contrary to directions and perhaps often contrary to what they know is right Teachers need much patience, but they must never lose sight of their goals. Both patience and persistence are constantly needed as well as fairness, frankness, and firmness, without being cross and peevish about it all.

12 *Make use of the law of substitution* When you are trying to uproot a bad habit you must make sure to put something new in place of the old New interests, new activities, new desires must be substituted for that which we seek to destroy

13 *Do not be so zealous in your effort to establish a new habit or to eliminate a bad one that your method and manner will be the means of producing other undesirable reactions* It is always best to be direct, not to talk any more than is necessary, and to be careful of the learning conditions and environment which are being set and which will suggest ideas and influence conduct.

**Development of interests, attitudes, ideals.** Knowledge of health facts and laws by itself is not enough to insure healthful living The old saying that "knowledge is power" is only a half-truth. When knowing has been changed into power to do and when good health habits have been formed, we have taken a decided step in our progress on the road to health But the most dynamic and motivating force in our lives, not only in the realm of health but in every phase of learning, is found in the de-

velopment of those interests, ideals, and desires which will initiate and control conduct. Nothing can take the place of a lifelong, genuine interest in matters of health which will prompt the individual always to seek new information and new and better ways of living We will do those things which we greatly desire to do One of the large functions of the school is to develop legitimate and wholesome desires through skillful teaching-learning procedures Desires, attitudes, interests, and ideals are born of knowledge. It is essential that the school should give the child every opportunity to know the truth, the scientific facts, as to vitamins, calories, need for oxygen, avoidance of infection, care of the nervous system, and all the rest If any child acquires an abiding interest and if he desires to know, he will learn of his own accord In all health activities the teacher should make every effort to arouse and maintain a strong personal interest which will surmount all difficulties in the effort to learn the ways of health

"An ideal is an idea (concept, meaning) which has a peculiar directive force over conduct because of the feeling of worth that attaches to it An ideal is a master idea " "An ideal is an idea surcharged with feeling, and thus is made an effective end or goal or standard of conduct " "Good habits are important to a good character, but it should be insisted that character is more than one's capital of habits " [1] Very early in life, before the child enters school, and later, many personal health habits are initiated and fixed to a greater or less degree; no doubt these habits of eating, of sleeping, of elimination, and others form the basis for the later development by the school of all those health ideals and attitudes which will have so much to do with the shaping of anyone's physical and mental condition and make-up. The teacher should understand that the learning of ideas, ideals, attitudes, habits, and skills is a composite and mutually reinforcing process. Understanding and skillful performance go hand in hand

[1] COLVIN, S S, BAGLEY, W C, AND MACDONALD, MARION E—*Human Behavior*, The Macmillan Company

**How is a health habit formed?** Let us suppose that the desirable habit to be formed and fixed is that of chewing one's food well How is such a habit formed? Dr Bagley tells us that "the process of habit formation may be stated under three heads (1) *focalization* of consciousness upon what is to be learned, (2) attentive repetition of the activity, (3) *permitting no exceptions* to occur until the habit has been established" It sounds technical and it is not as easy as it appears Focalization has to do with getting a clear and correct idea of what is to be done What is meant by chewing one's food well and why do it? Here is a place for correct knowledge of the relation of chewing to the processes of digestion The child must clearly understand the need for thorough chewing before he will have a strong desire to initiate the habit Moreover, he must have a favorable attitude toward the new habit to be learned "The attitude which one takes toward the habit to be formed is a fundamental factor in the effectiveness of the habit-forming process" It is of the utmost importance that there be the *will to learn*. If a child really wants very much to chew his food well because he sees that it is desirable to do so, he has already half won the battle Teachers should use every possible means to secure a good start. Dr James said, "Launch yourself with as strong and decided initiative as possible." Dr Bagley states that "the importance of attitude in learning is brought out by some psychologists in the *law of readiness*"

Two weeks of chewing one's food well through thoughtful, purposeful, attentive repetition, without suffering any lapses to occur will in most cases get the habit very well under way. The first two weeks will be the hardest There must be no halfway measures and no tendency to say, "Well, I will not count this time" No, to make chewing well a habit one must mean business. Any devices or expedients which one may use to prevent falling back into old ways should be adapted It will not do for one to forget, so a card may be prepared with the proper reminder upon it, or, a string may be tied around a finger A sheet of paper may be ruled for let us say a month, with columns

for the three meals of each day. Then a record may be made of the repetitions. When the child has such visible evidence of progress, he will be encouraged to continue. It is better not to attempt to form more than one good habit at a time. Every effort must be made to motivate the repetitions. If one method does not succeed then others must be used.

The importance of permitting no exceptions was never better stated than by William James,[1] who said: "Never suffer an exception to occur till the new habit is securely rooted in your life. Each lapse is like letting fall a ball of string which one is carefully winding up; a single slip undoes more than a great many turns will wind again. *Continuity* of training is the great means of making the nervous system act infallibly right. . . ." In all this work of habit forming, and it is a very large part of all the learning in the elementary grades, teachers must realize that children do willingly what they like to do. That explains the habit-forming possibilities of plays and games. All the accompaniments of habit formation should be as interesting, as pleasant, and as attractive as it is possible to make them. First, the child should be shown exactly what to do and how to do it, and reasons should be given for doing the things which appeal to the child; then repetitions must be motivated in every possible and legitimate way.

**Which health habits?** Every rural teacher should make out a list of health habits which she can use in her own particular school. Some of these habits are of a general character and will need attention in the learnings of the entire group, while others pertain to the needs of individuals. Both good and bad habits are listed and given consideration in any modern series of health books. Many of the state courses of study have complete outlines of habits and of activities for developing them. Good personal habits relate to various matters of cleanliness, to care of the teeth, eyes, ears, hair, etc.; to posture, to selection and eating of food, to use of the handkerchief; to cheerfulness, sleep, exercise, and fresh air; to drinking of water and milk, emotional con-

[1] *Habit*, Henry Holt and Company, N. Y.

trol, regularity of elimination, and many other things The teacher will also find that she must uproot or eliminate many bad habits, which can best be done by the method of substitution Such bad habits as putting various unclean articles into the mouth, eating too fast, grouchiness, stooped postures, insufficient drinking, neglect of bathing, cracking nuts with the teeth, biting nails, using soiled handkerchiefs, picking the nose, coughing in another's face, and so on, to great length—all these must receive the parents' and the teacher's daily attention This teaching should be carried on with the minimum of self-consciousness and the maximum of objectivity Children need to become health-conscious, but not unduly self-conscious

In order to know what habits are now being stressed in the best schools, teachers will find it very helpful to read the section on "Habits," pages 40–46, in the Teacher's Guide of the *Health and Growth Series* [1] for grades 3 and 4 There are many things mentioned on these pages to which any thinking teacher may very wisely and profitably give heed Above all things, teachers should try to avoid any undue attitude of priggishness The unduly self-conscious health attitude defeats its own purpose; the school should seek to realize the objectives of healthful living by impersonal, objective procedures

**Possible teaching-learning activities.** The possibilities in the way of health activities on the part of teacher and pupil are practically without limit Read the article entitled "The Choice and Use of Health Activities" in *Hygeia* for July, 1933, or "The Rural Teacher's Opportunity" in the same magazine for June, 1931 There is also a good discussion on "How the Rural School Can Promote Health in the Community" by Dr W. W Bauer in *The Nation's Schools*, November, 1933 Miss Jeanie M. Pinckney in the first article referred to above enumerates ten different types of activities and gives several examples of each. The general classes are hand construction, physical activities; self-expression; group activities; visual aids, excursions; writing, collecting, reading, experimenting Among the examples under

[1] The Macmillan Company 1935

these headings we list a very few for illustration, as follows: Cutting out pictures of healthy people, cartoons of cleanliness practices in the home, relief exercises, first-aid practices, demonstrations of table manners and discussion and solution of problems relating to table manners; dramatizing getting ready for school, daily inspections, recording height and weight, accidents, sleep, and temperature of room, committees for window ventilation and bulletin board, word pictures, color flash cards, stereopticon slides on milk production, movies of posture and of mosquitoes, excursions to heating plant, parks and gardens, and to museums to see exhibits of Indian life, writing a health book, graph of rat's growth record; making of charts and calendars, collecting newspaper items and materials for a school museum, reading supplementary books, encyclopedias, and periodicals, experimenting, which will include "problems involving questions, observations, judgment, skills, testing and conclusions" At the present time any rural teacher will be able to make use of some activities at any rate which give greater reality and meaning to her health program

**Learning health through group activities.** In one rural school of about thirty pupils the visitor arrived one winter day just before the afternoon recess on Friday Teacher and pupils devoted the last quarter-day session to the school society On this particular day, beside the regular literary program of singing, speaking, and other exercises, the time was devoted in part to the election of officers and of the members of several committees. These officers and committees held office for one month, thus giving everyone a chance to serve in some capacity, or in different ways, several times during the year. One committee kept the toilets in good condition, another looked after the ventilation by means of the windows, one pupil to each window; another committee read and recorded the temperature at frequent intervals and aided in stove-damper adjustments Three children kept the blackboards in good condition and cleaned the erasers out of doors Two pupils kept waste paper picked up in the building and on the grounds The school had a good well;

two pupils kept the tank filled with a constant supply of fresh water One boy was intrusted with keeping the water in the vaporizing pan at a good level. There were other committees who were actually elected by the group and not appointed by the teacher, although she had constant oversight and supervision The teacher told the visitor that the pupils really enjoyed their responsibility and did their work as a rule very creditably. In other schools there is a Junior Red Cross or a Health Crusade, or a 4-H Club, or the Boy Scouts, or the Girl Reserves, or the Young Citizens' League, or the Knighthood of Youth In all of these organizations health and character are the two principal objectives Every rural teacher needs some such form of organization for the promotion of health and sanitation

**Things for pupils to do.** The most important thing of all in the health program is well-directed and well-motivated pupil activity What the pupil *does*, instead merely of what he thinks or knows, is the vital matter In the Teacher's Guide to *The Health and Growth Series*, page 26, the authors say that

> The Things to Do in every chapter are an essential part of the text. It is not an "extra". It emphasizes activities which are an integral part of the health curriculum The exercises are diversified in order to appeal to individual differences in intelligence, interests, and environment The teacher should encourage each pupil to do as many of the exercises as may be educative for him.
>
> If Things to Do are carried out as suggested, health instruction becomes an integrated course involving to some extent reading, writing, arithmetic, geography, history, composition, oral English, and drawing The teacher or superintendent cannot consider the time spent on health education as time totally withdrawn from the tool subjects because skill in reading, writing, and composition is being acquired while working on health problems

In order to illustrate what it is possible for children actually to do to further their own health education, several samples of things to do are here taken from *Keeping Healthy* The following shorter suggestions and directions are taken from various parts of the first book of the series named above

1. Write all the things you want to do to get ready for morning inspection

2 Wash your hair in the same way that Dick washed his

3 If you have no bathtub, plan a way in which you can take a warm, allover bath twice a week.

4. Read this story about clothing to your mother if she would like to hear it

5 Look through your other books to learn more about the kind of clothes people in other countries wear

6 Suppose you were in Bill's or Betty's place and had five or ten cents How should you spend it?

7. Visit a farm or dairy to see where the milk you drink comes from and what is done to it before it reaches you If you live on a farm, you can answer these questions now.

8 Make a class collection of all the kinds of grain you read about in this book.

9. Think of something pleasant to tell your family at the evening meal every night this week

10 With the help of your teacher write a play about Jean and her cold Give the play before a lower class You could have four scenes for the play

*Scene I* Jean comes home from school and talks with her mother
*Scene II.* Jean plays out of doors.
*Scene III.* Jean takes off her coat indoors and talks with her father.
*Scene IV* Jean's father and mother talk with each other after Jean goes to bed

Read the story again to find out just what Jean, her mother, and her father say in each scene

11. If you have a friend who has been very sick but is getting better, send him some picture puzzles or clay so that he will have something to while away the time with till he is well.

12. Begin at the beginning of the list of habits you have made. Mark yourself on each one for this month.

13. Make a poster of your vacation health habits for your room at home

14. Draw a map showing the best places to play in your neighborhood.

15 Make a safety exhibit Find or draw pictures showing how to prevent automobile accidents, cuts, scratches, falls, and burns.

16 Watch the thermometer in your classroom. How can you keep it about 68°?

17 Bring some fruit for your midmorning or noon lunch

18 Practice settling every quarrel or difference of opinion so that everyone will be satisfied If you cannot get what you want, let the matter drop and become interested in something else.

**Individual checking records of health practices.** It is now common to use a variety of blanks, graphs, charts, and tabulations by which both teacher and child may have visible evidence of accomplishment, whether creditable or otherwise For example, on pages 23 and 24 of *Keeping Healthy* in the *Health and Growth Series,* we find under Things to Do this direction, No 9. "Have a contest to see which row in your class comes to school most often with clean hands and nails Use a large sheet of squared paper for the record Let each square stand for one child who has clean hands and nails If four children in the first row have clean hands and nails, color four squares for them You can use a different color for each row Color new squares every day."

A sheet can be ruled for the diet record of each child for each day of the week, list such items as these down the left-hand side of the page Did you chew your food well? Did you take at least 15 minutes for eating? Did you wash your hands first? Did you drink coffee? Did you drink five glasses of water today? Did you eat between meals? How many glasses of milk did you drink? The rural teacher should rule a form for her entire school on which she records all cases of sickness Choose symbols for each type of sickness and insert the proper letter *C* may stand for colds, for example There will be as many columns as there are weeks in the year and as many horizontal spaces as there are children The statements in this section are merely suggestive of many other records which may be made by the teacher or by the individual pupils

**Measuring results in health achievements.** On page 196 of the 350-page book entitled One-Teacher Elementary Schools, published by the Department of Public Instruction of Pennsylvania, we find the following·[1]

1 *Measurements for Teacher*

(1) Am I setting before my pupils an example in health practices, in desirable attitudes toward healthful living (appearance, posture, health habits, annual health examination)?

[1] Courteous permission to use this has been given by the Pennsylvania State Department of Education

(2) Am I providing for my pupils as healthful environment as possible in my room (ventilation, temperature 68°, humidity, cleanliness, tidiness, light, seat adjusted to pupil)?

(3) Do I visit the home that there may be a better understanding between the home and the school?

(4) Am I expecting results that affect the health of the pupils?

(5) How many of the following fourteen items listed under "Measurements for Pupils" have I given enough attention to secure results?

2 *Measurements for Pupils*

The purpose of this list is to help the teacher recognize conditions or activities which are related to the health of the pupils By questioning herself on the results in these, she will have a clearer realization of whether her teaching and influence are helping to maintain good or improving poor conditions found at the beginning of the year

(1) Attitude of pupils toward health behavior (This is manifested by their interest and pleasure in health activities as shown in face and voice, or as expressed in words or acts )

(2) Appearance of pupils (cleanliness, tidiness, posture).

(3) Appearance of pupil's desk and floor underneath

(4) Use of playground by pupils.

(5) Conduct of pupils during lunch period

(6) Responsibility taken by pupils for certain duties which help maintain hygienic conditions at school and promote desirable attitudes toward health practices, *e g*, adjusting shades, reporting temperature of room, preparation for lunch.

(7) Social adjustment with other pupils.

(8) Working attitude of the pupils.

(9) Decrease in absence due to illness and accident

(10) Correction of physical handicaps

(11) Immunization against diphtheria and smallpox.

(12) Increase in weight of pupils.

(13) Health-habit questionnaires, records, and other devices. (These may determine health habits formed, those in process of formation, and those still unformed by pupils )

(14) Health-knowledge tests appropriate to grade level given at beginning and end of terms (Such tests help to give teacher and children some measure of their achievement )

The Gates-Strang Health Knowledge Test is probably the most widely known This test is designed for grades 3 to 8, and comprises 90 pages of over 500 points. It is published by the

Bureau of Publications, Teachers College, Columbia University, New York City

One of the Public School Achievement Tests, Battery C, forms 1, 2, 3, and 4, for grades 4 to 8, consists of tests in health and nature study This may be obtained from the C A Gregory Company, 345 Calhoun Street, Cincinnati, Ohio Send to this company for their general catalogue of all types of tests

Interested teachers may send to the Public School Publishing Company of Bloomington, Illinois, for A Scale for Measuring Personal and Social Behavior, for grades 1 to 8 Many phases of health are given space, such as posture, exercise, food, sleep, and safety Ask also for the general catalogue of tests

Teachers and students should read pages 144–152 in *Health Education* on the subject of Measurement in Health Education and should write to the National Education Association, Washington, D C, for lists and prices of health tests and for much other material pertaining to health education Ask for the circular describing Health Education Publications

**Emotional health and self-control** The student and teacher will find the subject of mental hygiene discussed in *Health Education*, pages 87–94 The little book, *Your Mind and You. Mental Health*, may be obtained from the National Committee for Mental Hygiene, Inc, 50 West Fiftieth Street, New York City, for 30 cents The secretary of this organization is Clifford W Beers, the author of *A Mind that Found Itself, an Autobiography* Every teacher should make a study of the subject of mental health and hygiene Burnham's *The Normal Mind* is also a very good book to read In every school there are children with unstable nervous systems These children worry about their schoolwork and are subject to various moods, depressions, and emotional disturbances which interfere with achievement and progress The teacher has a duty in the matter of mental health as well as in that of bodily welfare The school system, the daily program of study and of class exercises, the manner of conducting tests, the general emotional atmosphere, all should contribute to calmness, poise, cheerfulness, and self-control. It is in

the field of mental hygiene that the teacher can do much by attention to individual needs Many children are suffering from nervousness and emotional stresses because they are not properly nourished. They do not eat balanced meals; they are not getting sufficient vitamins and mineral salts because they do not eat enough fruit, vegetables, and milk It often happens that the total of food calories for the twenty-four hours is below standard Aside from malnutrition, which is common, in many homes and schools little effort is made to protect the child from the harmful effect of strained human relationships Playground occurrences and incidents of the trips to school in the morning and back home at night may account for many mental troubles of sensitive, nervous children, who are frequently the victims of both heredity and environment

Here are some guiding ideas for the teacher to keep in mind as precautionary or preventive measures in the realm of mental hygiene

1 Teach your children to face the facts of life as they are, and bravely to find ways of overcoming personal difficulties. Show the dangers of purely imaginary solutions of real problems

2 Arrange the program of study and activity so that every child actually succeeds on some decent and respectable level

3 Study the behavior of individuals so as to discover their personality problems and then aid them in finding satisfactory solutions

4 Make every effort to overcome malnutrition by giving correct information, the noonday warm lunch, securing the co-operation of mothers and others, and doing whatever else may be necessary

5. Do not permit a child to continue doing poor work Discover the causes and eliminate them Give each child something to do that he is capable of doing

6 Never permit problems of discipline to disturb the entire school. Settle cases quietly, firmly, individually.

7 Be alert to assure for each child a square deal in the school and on the playground Do not permit the weaker children to be mistreated or browbeaten

8 Arrange to have the school program include adequate relaxation, rest, recreation, change, and freedom for self-expression It is not uncommon for the dreary sameness of school life, with its uninteresting and deadening procedures, to produce a most detrimental mental condition.

9 Teach and train every child to stand up for his own rights, even to fight for them if forced to do so. School and home should make every effort to develop a spirit of real courage and proper independence

10 See to it that the program of work and play is well-planned, objective, definite, and direct The child needs to feel that he is taking part in a going concern, in an enterprise which is of genuine personal value to him So far as possible, abnormal doubts, uncertainties, and misgivings should be eliminated

11 Do not permit any system of marking or the use of report cards to have such a bad mental effect upon the child as to outweigh any other possible good results

12 Try to maintain in the school at all times a spirit of friendliness and helpfulness Children should feel free to go to the teacher when they are troubled with fears, worries, and doubts about their school experiences

13. You, the teacher, will need to analyze your own personality to find out whether you have that emotional balance and control which is so important for all those who are engaged in schoolwork [1]

**What any rural teacher can do.** There are many practical and helpful things which the average rural teacher can do in carrying out a program of health education, and among these are the following, stated imperatively and briefly:

1 Definitely understand and appreciate the fact that health and character education are the fundamental responsibilities of the home and the school and that they are inextricably interdependent Intellectual education without the other two is ineffectual and often calamitous

2 Utilize the modern Health Crusade, the Boy Scouts, the 4-H Club, a school society, or some other similar organization to aid in promoting both health and character objectives

3 Work through a mothers' club, a P T A or a similar organization to secure the co-operation of parents and to keep parents informed of health conditions and the needs of individuals and of the whole school

[1] See *Health Bulletin for Teachers*, Vol VI, No 7, March, 1935, entitled "Emotional Hygiene," published by the Metropolitan Life Insurance Company Procure a complete list of these important bulletins and of other health publications of this company

4 Be a good housekeeper This means knowing what to do in all matters of cleanliness and school sanitation and then doing it each day as a matter of habit

5 Make all health activities interesting and attractive This can be accomplished by using modern teaching-learning materials and procedures

6 Know the symptoms of contagious disease and do not temporize or procrastinate when perhaps the welfare of the entire school is at stake. Post in a conspicuous place the large sheet from the State Board of Health, giving the facts

7 Study the evidences of malnutrition which you note in your children and take steps toward improvement, particularly through the noonday meal and by securing a greater consumption of milk, fruit, and vegetables

8 Make a complete health survey of your school, carefully record the facts, and keep the record up to date In this important enterprise secure the co-operation of the county nurse, if there is one

9 Collect as much useful material and information on the subject of health and health education as you can find Procure a good-sized, strong pasteboard box in which to keep magazine articles, newspaper clippings, pictures, cartoons, etc Add continually to your collection Pupils can aid greatly in this project

10. See that your reports to parents carry necessary and useful individual health information You can procure blank forms for them It is the duty of the teacher to keep parents informed regarding health conditions, character development, and scholastic achievements and progress The old type of report card should be discarded

11 Place the *Children's Charter* and the *Child's Bill of Rights Poster* on the bulletin board Study and use these basic ideas

12 Get a Classroom Growth Record wall chart (about 24 × 20 inches), post it up, and enter regular records of height and weight

13 Use the suggestions concerning measurement in this chapter and send for specimen sets of objective tests.

14 Try to secure the best, most up-to-date textbooks, workbooks, and supplementary books on the subject of health Perhaps your county superintendent can assist you in this regard. Read the advertisements in educational magazines and send for catalogues, price-lists, and other materials Use such health workbooks as those published by the Webster Publishing Company of St. Louis. There is a book respectively for grades 1, 2, and 3, for 4, 5, and 6, for 7 and 8 Sixty or more pages, 7 × 10, in each book are filled with questions, directions, tests, and exercises which will keep the pupil profitably busy The cost is small and each child will, by this procedure, be engaged in making a personal and permanent product which should mean much to him then and later

15 Do not use any formal procedures in health education Depend largely on carefully directed study activities and timely exercises, such as might arise in connection with the weather or a school-yard accident, combined with group discussions, omitting all recitations of the old type Many activities for the development of habits must be utilized, but they will fail unless motivated by suitable interests and attitudes

16. Correlate health activities with as many school subjects as possible This problem is discussed in *Health Education*, which may be procured from the National Education Association or the American Medical Association This book is the teacher's health bible The price is $1 25 (latest edition, 1930).

17 Teach children how to solve personal health problems, but avoid developing health self-consciousness

18. For your own benefit as well as the good of your pupils, cultivate healthful living and practice the accepted ways of the efficient, happy life for yourself

19 Purchase, or have the board buy with school funds, a simple first-aid outfit and learn the ordinary first-aid procedures and skills. This may be of the greatest service in any rural school when the need arises, as it often does

20. Do not forget that very often the most effective health instruction is indirect and incidental, as well as individual, also.

The most fruitful and lasting learning is that which grows out of individual and immediate needs

21 You will find much instructional material relating to health in your school and in the community if you have the knowledge and the initiative which is necessary to find such things

22 Remember that today we know that health objectives include a study of mental hygiene and mental handicaps—mental health, in short Mind and body are very closely related and mental health and physical health go hand in hand Modern health textbooks discuss the subject of mental hygiene and mental health

23. Make an effort not to teach any facts of anatomy or physiology which have no functional value or bearing on healthful living

24 Let your health program most certainly include the latest scientific, useful, and usable information concerning the selection of nutritious foods, the balancing of meals, the functions of vitamins and mineral salts in the diet, and the need for bulkage as a prerequisite to regular elimination

25. Use much discretion in securing the co-operation of parents, nurse, physician, dentist, board of health, or other agencies Without the co-operation of parents not much can be done in building health habits

## REVIEW, TEST, AND PROBLEM EXERCISES

1 If you had it in your power, with entirely adequate funds available, what would you do for the children in a rural school district to make the health situation as ideal as possible? Do not overlook any means or agency for constantly improving the personal health of every child

2. Make a practicable health program for an average rural teacher for one school year, including what she can do and what her pupils can do actually to improve health conditions

3. Using four different types of objective tests, make out a health-knowledge test which could be used at the end of the fourth-grade work The test should comprise at least fifty most important items.

4. Indicate as many different sources of health materials as possible which are available to the ordinary rural teacher Include national associations and organizations and private companies, such as the Metropolitan Life Insurance Company.

5. What types of pupil-study activities, including the use of workbooks, are possible in carrying out a health program? When teacher and pupil engage in group discussions, what should be the nature of such class exercises, if we agree to omit the old oral, question-answer procedure as well as topical recitations

6. Give twenty directions and suggestions to a beginning teacher on the procedures which she may use when there is at hand a three-book series of health texts for grades 3 and 4, 5 and 6, and 7 and 8.

## REFERENCES FOR THE TEACHER'S READING AND STUDY

In the book entitled *Health Education A Program for Public Schools and Teacher-Training Institutions*, which may be obtained from either the National Education Association or the American Medical Association, the teacher or student will find extensive and valuable bibliographies on all phases of health instruction. This is the *first book* on health education for the teacher to procure.

The proceedings of the Health Education Conference held at Iowa City, Iowa, June 19–22, 1935, and entitled *Principles and Practices in School Health Education, 1935*, comprises 363 pages of the latest general discussions of health problems, much of the material relates to rural schools This valuable report may be obtained from the National Education Association for $1 50

The latest complete series of health books (three- or six-book edition), entitled *Health and Growth Series*, was published by The Macmillan Company in 1935 Send to this company, New York, Chicago, Boston, Atlanta, Dallas, or San Francisco for their informational material The three manuals, called *Teacher's Guides*, which accompany these textbooks, contain many useful suggestions concerning the teacher's part, methods of using the texts, units, habits, typical procedures, supplementary readings, and other topics. There are extensive lists of references.

## CHAPTER XXV

## MEASURING MENTALITY AND ACHIEVEMENT

**Old and new in measurement.** The older tests were indeed inadequate in many ways, especially if not properly conducted, but the new standardized and objective tests are not without some elements of weakness. The fact of the matter is that teachers should make use of both the old essay examination and the modern intelligence, achievement, and objective tests, as they can be made mutually supplementary in the realization of important and desirable educational objectives. Recent experimental studies have shown that the essay type of examination can be made more reliable if the questions are worked out very carefully and a key for scoring is provided at the same time. It is entirely possible to improve the essay examination by the use of scientific principles of measurement.

Twenty to thirty years ago not many school people questioned the validity or usefulness of the common essay type of examination, with its usual accompaniment of a marking system based to a considerable extent upon the personal judgment of the teacher. Today, however, we know that the exclusive use of such a measuring instrument is quite inadequate as the sole means of determining achievement and progress. It is difficult, often actually impossible, to discover individual deficiencies, by means of the traditional examination. Every teacher needs some reliable means by which she can ascertain the approximate status of each member of a class, in order to help him overcome specific weaknesses. Modern diagnostic, prognostic, aptitude, and practice tests, which are of a much more accurate specialized and objective character than the older tests, are the means of attaining more accurate educational measurements than were possible before.

The old essay examination had distinct values which should warrant teachers in still making some controlled use of it Some of its weaknesses can be overcome Questions can be greatly improved and scoring can be made more objective and accurate The new objective tests do not ordinarily measure ability to organize subject matter, they do not usually test skill in seeing relations, drawing conclusions, or interpreting a situation or a group of factual statements However, objective tests can be so constructed that they will demand from the student much more than the mere setting down of unrelated memory items, often of an insignificant and more or less irrelevant character It is not easy to make out high-quality questions of either the old or the new variety While the old examination often did not measure what it was supposed to measure—achievement and progress—it is likewise true that present-day objective tests may also fail to be reliable measures when carelessly prepared and administered In the last analysis, success or failure in measurement is determined by the teacher's personality, teaching qualifications, and educational objectives We have had altogether too much hit-or-miss testing, devoid of educational value and costly of time, energy, and money

**What can we measure?** In general terms it may be stated with fair accuracy that we can measure two things in the field of education *intelligence*, or nativity capacity, and *achievement*, or progress in the work of the school We now have tests for measuring both general intelligence and special intelligence or aptitudes The symbol for the measure of general intelligence is the I Q, or the figure representing the mental age In the field of special intelligence we now have such aptitude or prognosis tests as the Stenquist mechanical-aptitude test and the Seashore musical-aptitude test Of course no intelligence test measures anything except particular behavior reactions It cannot measure anything of an innate character any more than we can measure electricity directly We measure the effects or the results of electric energy, we measure the behavior responses of the individual which are the results of his experience and learning

up to the time of giving the test. Achievement tests measure knowledge and reasoning and to some extent appreciation. A good achievement test discloses the pupil's knowledge, ability, and skill in some subject or portion of a subject. The purpose of a prognostic test, which is a variety of intelligence rather than of achievement test, is to predict in advance the child's possibilities of achievement in some particular field. The special type of prognostic test which we call the aptitude test now has rather wide use in vocational guidance. It is now possible, also, to do considerably more than heretofore in the measurement of personal attitudes and character traits. Various tests and rating scales at the present time do secure some useful data in determining an individual's power to judge in moral situations. We are gradually learning how to measure with some success what we call personality. The method is of course to study and determine the nature of the personality manifestations as shown in the individual's conduct.

A child begins school at six years of age with a mental equipment which is the combined result of his heredity plus his experience up to the date of enrollment. It is highly desirable that the teacher discover the child's capacities and abilities as soon as possible, in order to adapt teaching-learning processes to individual needs. Many, or most, rural teachers, even today, guess at the child's mental status and make use of trial-and-error procedures. This is no longer necessary, for by the use of modern tests, especially if they are repeated at intervals, the teacher may get a very trustworthy measure of the child's ability. As the work of the school goes on, the teacher can now use various types of achievement tests, diagnostic tests, spelling and writing scales, inventory tests, pretests, mastery tests, as well as the older type of test, to ascertain the results of her teaching and of the child's learning. She can test the child's knowledge, his memory, and his ability to think, to study, and to solve problems. She can discover his methods and habits of work, his power of appreciation; in general she need not guess nearly so much as formerly.

**Nature and function of norms.** A chief weakness of the older measures was the lack of generally recognized and accepted standards In the use of modern measurements, which have become quite accurate, effective and common authoritative standards or norms are set up These have been secured by giving tests to very large numbers of children to discover the average or normal tendency of different groups in various sections of the country For example, if twenty-five thousand fourth-grade pupils are tested on a given list of words and the results carefully tabulated, an average result, mean, or norm will be ascertained indicating the performance of an average pupil in this subject and grade It is not difficult to see that the setting up of a scientific standard, derived by experiments and repeated testing over a wide area and in many different schools, is far different from the use of a single teacher's personal, subjective standards We now know quite definitely what an average fifth-grade pupil, for example, can do in spelling, in writing, in reading, in arithmetic, or in other subjects These facts are known because of long-continued and repeated tests in many schools taught by many teachers Modern tests are standard tests because they make use of authoritative, scientifically ascertained norms or standards There are now several good writing and spelling scales on the market which enable teachers to measure age and grade abilities with much accuracy "An age norm is the average score of a large number of unselected children at the given age " "Grade norms are the average scores of large groups of children in each grade "[1]

**Types of modern measures** If the young teacher or student desires to know something of the enormous number and variety of tests and measures which have been developed during the past twenty years or less, it will be very informing to write to the C A Gregory Company of Cincinnati, Ohio, or the World Book Company of Yonkers, New York, or the Public School Publishing Company of Bloomington, Illinois, or other publishers. There are at the present time hundreds of achievement tests in

[1] LINCOLN AND WORKMAN—*Testing and the Use of Test Results*, The Macmillan Company 1935

the various subjects of the elementary school, as well as in those of the secondary school. We now have rate or speed tests, power tests, quality scales in handwriting, drawing, composition, and sewing; accuracy tests, range tests, survey tests, and tests of comprehension, organization, judgment, and other abilities These tests seek to discover the abilities of pupils in the usual school subjects

If the main purpose is to discover special weaknesses, as for example in comprehension and rate of reading, the tests are known as diagnostic tests Such tests give the teacher exact knowledge of individual difficulties which will make specific remedial work possible There are now large numbers of such tests in every subject of the elementary school The Osburn Revised Inventory Tests in Arithmetic, for example, published by the Public School Publishing Company, are used extensively and successfully They are easy to give and can be scored in two minutes with pupils assisting These tests assume that we should teach a child what he does not know, but that we do not need to teach a child what he does know and can do Intelligence tests, both individual and group tests, have been in use for a long time The army group-intelligence tests were used extensively and with great advantage at the various cantonments during the war Self-administering tests of mental ability have been found advantageous in simplifying intelligence testing. There are several of these on the market and they are relatively easy to use and to score

**Characteristics of a true measure.** Many writers have set up criteria for judging the fitness of a given test or measuring device. No modern standard test is perfect, but modifications are constantly being made; these measures of pupil abilities are becoming increasingly reliable and useful It is now understood that a scientific test should possess at least the following attributes as nearly as may be possible

*First*, the test should be a measure of the knowledge, habit, skill, or other reaction that it is expected to discover or disclose. Validity is a prime quality of any dependable test

*Second*, so far as may be, the test should be objective rather than subjective Each question should usually have but one answer, the teacher's personal impressions should in nowise determine the mark This is easy in arithmetic and with all factual material, but difficult in those subjects and topics where several answers may be equally good and correct.

*Third*, the test must give the same results every time, that is, it must be reliable If the test cannot be depended upon for fairly uniform measurement it is useless It is then not a standard instrument.

*Fourth*, the divisions of the scale and the values of the different parts of the test must be equal On a foot rule it is one inch from two to three, and exactly the same from nine to ten Such uniformity of valuation must be true of a reliable standard test

*Fifth*, the children must be attracted by the test so that they will try to do their best If they don't like it, the results will be unsatisfactory, whether because of the uninteresting character of the test itself or of the unskillful way in which the teacher administers it

*Sixth*, a good test is relatively short and easy to give If the teacher herself is to give the test, as should often be true, it must not be complicated or take too much of the teacher's time If long and difficult, teachers cannot be induced to do the work well, they will find excuses for not doing it at all

*Seventh*, the best tests cover as many grades as possible, the more the better, for then a rural teacher, for example, can compare more pupils with one testing and thus have a wider gauge of her school The time element is an important consideration.

*Eighth*, a standard test should provide reliable norms This is now generally done; it enables the teacher to compare her pupils with the average child of this country of given age, grade, and subject This is obviously very desirable

*Ninth*, if a test is well constructed, it will discover not only lacks or failures, but the specific causes for lacks or failures The diagnosis of individual weaknesses, to pave the way for definite remedial work, is highly important; a scientific test realizes this

purpose The diagnostic test is probably the most useful of all tests

*Tenth*, extraneous elements or those not essential to the particular subject matter of the test, such as handwriting, punctuation, spelling, etc , do not affect the grade or mark, as may be the case in old-type tests Writing and spelling may be measured at other times or in other ways; although, if it is so understood by all, they may sometimes also be judged on a single test

**Modern measurement not infallible.** A teacher makes a mistake if she looks upon the standard test as a panacea for all the ills of the school They are a most valuable means of ascertaining individual abilities and weaknesses, but they cannot, in the nature of the case, take the place of individual instruction and guidance in study and learning. Teachers will do well to bear in mind that intelligence, prognostic, and achievement tests are incapable of testing many elements of personality which are important from any point of view related to success in life Intelligence tests are of the greatest value in determining a pupil's status in school, but great dependence should not be placed upon the results of a single test In some school systems the I Q. has been given altogether too much weight No child should be marked as an inferior, wholly incapable of learning and doing certain things, because of the results of any one test—or even of many tests, for that matter. The good teacher has great faith in the need for and value of skillful teaching. Every child is entitled to a full opportunity to learn and do all that he can with his own particular abilities. The wise teacher does all she can for every pupil in her school regardless of the I Q It is now known that *nurture*, in the form of all sorts of educational opportunities, will do very much to neutralize or overcome the weaknesses and shortcomings with which a given child is supposed to be handicapped by *nature* or heredity. The intelligent teacher does not rely wholly on intelligence or other tests in her efforts to promote the progress of her pupils Modern tests vary greatly in their validity and reliability Teachers should secure expert advice in selecting tests, and they should try to find tests

which are adapted to their own special conditions Even the best tests in the hands of a weak teacher may do more harm than good. It is impossible to work out standard tests, accompanied by the simplest, most direct instructions, which are foolproof

**What is the nature of intelligence?** According to the latest edition of the *Webster's International Dictionary* [1] (1934), intelligence is "the capacity for knowing and understanding, especially as applied to the handling of novel situations", or, "the power of meeting a novel situation successfully by adjusting one's behavior to the total situation" Intelligence is not easy to define, perhaps it is incapable of brief accurate definition Psychologists are not wholly agreed as to the exact nature of intelligence, but Binet, a French psychologist and the famous originator of distinctive tests of general intelligence, placed *sound judgment* as the central element of intelligence Intelligence is the capacity, seemingly a product of both inheritance and experience, to take advantage of opportunities, or to adjust oneself to new situations or requirements by thinking. A person of intelligence uses persistent effort in steadfastly pursuing a fixed purpose leading on to successful accomplishment It should be carefully noted that intelligence *is capacity* to respond, to learn, to know, to succeed; it is not merely the body of knowledge acquired as the result of experience. Stroud says [2] that "Intelligence may be defined as the ability to utilize past experience" Intelligence is *ability* to learn and to remember

Undoubtedly the degree of any person's general intelligence is basically or essentially determined by the character of his heredity We know that idiots and morons are "born short" and will never be made different by the most helpful environment; we also know that genius, or very superior intellectual capacity, is also a matter of inherent, innate ability to respond effectively to the environment It is very likely a condition of inherited nerve

[1] Reproduced by permission of the publishers of *Webster's New International Dictionary*, Second Edition Copyright 1934, by G and C Merriam Company, Springfield, Mass

[2] Stroud, J B —*Educational Psychology*, The Macmillan Company 1935

structure or a characteristic type of central nervous system which determines intrinsically how high one's I Q may be or become. It goes without saying that environmental influences have very great weight, but no amount of education can ever make a dull individual into a bright one. However, the dull student, for example, may achieve much by industry and effort, while the brilliant student, because of laziness or indifference, may actually fall very short of his possibilities in the way of learning It is clearly always a case of inherited possibilities of learning, plus opportunities for learning, plus the way the individual uses those opportunities No doubt all achievement is the product of response to environment But the extent and the character of our responses are certainly limited, more or less, for everyone of us, by our native endowments

Dr Thorndike believes that instead of general intelligence there are three phases or types of human intelligence: abstract, social, and mechanical The author has known automobile mechanics who seemed to be and were highly intelligent and skilled in their particular field, but who had never been able to complete eighth-grade arithmetic, or if they entered high school, were floored by algebra or geometry They possessed a high degree of mechanical intelligence, but were low in the realm of abstract intelligence

The writer has known young teachers who apparently could be ranked high in social intelligence but whose I Q , determined by general intelligence tests, was below 100 These young women were very bright and keen in matters of human relationships and they possessed the happy faculty of liking people in general and of getting on well with parents, board members, pupils, and others In abstract intelligence these teachers were relatively weak, in social intelligence they showed much evidence of being sure of themselves and of being able to acquit themselves with credit in social situations. The concept of general intelligence is a very useful one, but there are many qualifications and modifications which should be taken into the general reckoning

**The grade of mentality varies greatly.** Children differ in a

multitude of ways, it is now understood that although differences are due both to heredity and education, the original native endowment or capacity has the largest influence Education only accentuates differences already existing, the dullness of a dull child or the brightness of a superior child becomes increasingly manifest Both children and adults differ in race, age, size, type of nervous system, quickness or slowness of response, temperament, type of memory, power and character of imagery, acuteness of the senses, habits, ideals, capacity for interest and attention, dependability, studiousness, cheerfulness, courage, sense of humor, temper, self-control, and social nature They differ in what we designate as general intelligence, that is, the general mental capacity to get on in life or to make one's way in the world successfully in competition with one's fellowmen Varying response to different situations is due in large measure to differences in natural capacity or intelligence.

Terman's classification of individual differences, based on intelligence quotients, is as follows [1]

| *Intelligence Quotient* | *Classification* |
|---|---|
| Above 140 | Near genius or genius |
| 120–140 | Very superior intelligence |
| 110–120 | Superior intelligence |
| 90–110 | Normal, or average intelligence |
| 80–90 | Dullness, rarely classified as feeble-mindedness |
| 70–80 | Border-line deficiency, sometimes classifiable as dullness, often as feeble-mindedness |
| Below 70 | Definite feeble-mindedness |

It has been found by making a large number of intelligence tests that about 60 per cent of all children have an intelligence quotient falling between 90 and 110 Twenty per cent are below 90, and 20 per cent above 110 This table shows a more detailed distribution of the I Q's of a considerable number of school children

[1] TERMAN, L M —*The Measurement of Intelligence*, Houghton Mifflin Company 1916

| | | | |
|---|---|---|---|
| I Q below 70 | 1 per cent | I Q 100–109 | 30 per cent |
| I Q 70–79 | 5 per cent | I Q 110–119 | 14 per cent |
| I Q 80–89 | 14 per cent | I Q 120–129 | 5 per cent |
| I Q. 90–99 | 30 per cent | I Q over 129 | 1 per cent |

The following classification is given in *Human Behavior* by Colvin, Bagley, and Macdonald

| | | | |
|---|---|---|---|
| Below 25 | Idiot | 90–110 | Normal |
| 25–49 | Imbecile | 111–119 | Bright |
| 50–60 | Moron | 120–130 | Very bright |
| 75–89 | Dull normal | Above 130 | Superior |

**Mental age and the I. Q.** We can now determine, then, about what average score a nine-year-old or a twelve-year-old child will make when the Stanford-Binet or some other good scale is used. Any twelve-year-old pupil can readily be tested and his mental age determined If he secures the exact twelve-year average score he is said to be normal If he makes the score of the average fifteen-year-old, his *mental* age is fifteen though he is *chronologically* only twelve If on the other hand, a twelve-year-old is able to pass only the tests for the average ten-year-old, two years under age mentally, his mental age is ten years If a six-year-old has a mental age of eight, then when he is eight chronologically his mental age will very likely have increased correspondingly; it will be approximately ten and two-thirds years This relationship will persist up to the maturity of the individual This is only another way of saying that the I Q. remains fairly constant Terman places the average maturity age at 16 and Thorndike at 22 For the large majority of people the mental age and the chronological age are about the same There are also many persons whose mental ages exceed their chronological ages and many who are below normal About two thirds of all people are normal, and one third are above or below normal.

I. Q means *intelligence quotient;* it is secured by dividing the mental age by the chronological age The I. Q is a very convenient expression for a child's mentality If a pupil is ten years old chronologically, but only eight years old mentally, his I Q.

is said to be 80. The decimal point is not used If another ten-year-old has a mental age of ten, his I Q is 100 If a third child ten years of age has a mental age of twelve, his I Q is 120 This first child is dull, the second medium or average, and the third bright or superior The three situations are shown thus.

$$\text{I} - \text{I Q} = \frac{\text{M A}}{\text{C A}} = \frac{8}{10} = 80$$

$$\text{II} - \text{I. Q} = \frac{\text{M A.}}{\text{C A}} = \frac{10}{10} = 100$$

$$\text{III} - \text{I Q.} = \frac{\text{M A.}}{\text{C. A.}} = \frac{12}{10} - 120$$

**Brightness and dullness.** Woodrow begins his very suggestive and useful book *Brightness and Dullness in Children* by giving a letter written by Francis Galton to his sister the day preceding his fourth birthday

My dear Adele
I am 4 years old and I can read any English book I can say all the Latin Substantives and Adjectives and active verbs besides 52 lines of Latin poetry I can cast up any sum in addition and can multiply by 2, 3, 4, 5, 6, 7, 8, (9), 10, (11)
I can also say the pence table I read French a little and I know the clock

Francis Galton Febuary 15, 1827

Although Francis misspelled February, he was a prodigy He was a very bright, or superior, child, whose I Q. would undoubtedly be around 175 In his book, *The Intelligence of School Children*, Dr. Terman gives the records or personal histories of dozens of children—dull, medium, and bright Chapter XI deals with Case Studies of Forty-one Superior Children

In nearly every school and practically in every class there are bright, medium, and dull pupils Terman uses the terms *superior* and *inferior* Both bright and dull pupils are retarded in the grades, but the superior child, notwithstanding common belief to the contrary, is retarded the most Many a pupil with a superior mind, a high I Q., is made to mark time because of the

rigidity of the graded system, and because his teacher does not possess the knowledge and the moral courage needed to place such a child where he belongs.

By the use of intelligence tests, repeated as often as necessary, and by the use of the various achievement or diagnostic tests, a teacher should ascertain early in the year the mental standing of each of her pupils Dull pupils require much drill and, in general, entirely different treatment from those of superior mentality This is no longer a field for guessing It is a case for clear, definite diagnosis. The dull child is not to blame for his dullness and should not be scolded or ridiculed The superior child should have a chance either to progress as rapidly as his superior abilities and his health will permit, or there should be an enrichment or differentiation of the content of the curriculum for the benefit of those who are able to do additional work or a higher type of work In many schools the bright pupil is not given a fair chance Often his teacher is not clearly conscious of the bright child's ability Both the inferior and the superior child should have an opportunity to do their best; this can come about only under a teacher who has a knowledge of the problem of individual differences and of the standardized tests of intelligence and achievement

**Content of intelligence tests.** The Binet-Simon scale contains a great variety of tests Memory, for example, is tested by the repetition of sentences ranging from three to twenty-six syllables in length, and by the repetition of digit series ranging from two to seven digits each There are several tests of "time orientation," including distinction between forenoon and afternoon, naming the days of the week and the months of the year, and giving the date Eye-hand co-ordination is tested by drawing geometrical figures from copy; wealth of ideas, by naming as many words as possible in a given time, perception, by the description and interpretation of pictures; logical association, by the detection of nonsense in such statements as "I have three brothers—Paul, Ernest, and myself", resourcefulness, by questions asking what one ought to do under given circumstances, as,

for example, if one's house is afire, if one is going somewhere and misses the train, etc There are also tests of language comprehension, of knowledge about common objects, of ability to comprehend and use abstract ideas, and of other intellectual powers [1]

**Advantages of intelligence and achievement tests.** Among the many advantages of standardized tests the following are important from the standpoint of teaching and learning·

1 They are of the greatest value for diagnostic purposes in discovering individual weaknesses and definitely pointing the way to necessary remedial procedures

2. They furnish a more exact measure for determining the classification and promotion of pupils, although they are by no means the sole criteria for this purpose

3 Educational tests used with large numbers of children afford reliable standards and norms; they may be used to measure much more accurately the achievements of pupils in the subjects of the curriculum.

4 The results of high-grade intelligence tests, when such tests are used often enough, are not materially affected by environmental factors Although educational opportunities affect the I Q to a varying degree, it is entirely possible to determine a child's mental age with much exactness; there is no comparison between such modern testing and the use of mere personal opinion without the aid of objective procedures

5. The objective quality of modern tests enables any teacher to obtain practically the same results each time, no matter what the subjective conditions of teacher or pupil may be Objectivity in educational measurements is a quality greatly to be desired

6 By the use of good tests a careful teacher is able to find the more essential, superior, worthy, or vital elements in any child's mental achievements and school progress In other words, when scientific, standard, objective tests are employed the teacher gets more precise knowledge of the net products of her teaching and of the pupil's learning

[1] TERMAN, L M—Article on "The Measurement of Intelligence" in *The World Book Encyclopedia*, W F Quarrie and Company, Chicago 1935

7. When standard objective tests are used the influence of the particular school, or class, or teacher does not materially affect the grade of any individual child as so frequently happens when subjective methods of grading and the intervention of personal bias are permitted to have great weight. A bright child in a group of generally low mentality will be discovered, while inferior pupils in a generally bright class will likewise invariably be found.

8. Good modern tests are one of the best motivating agencies that the ordinary teacher can use. The incentive to work and to improve, which is inherent in judicious testing, and which is one of the common by-products, is an outstanding advantage of the testing movement, as we see it today.

**Revisions of the Binet-Simon Scale.** Over fifty years ago Ebbinghaus tried unsuccessfully to measure intelligence, which he thought to be a general mental power. In 1905, Professor Alfred Binet of Paris devised his first successful scale for measuring intelligence, which he conceived to be a combination of many mental abilities. In 1908 and 1911 Binet and Theodore Simon, a Paris physician, perfected intelligence tests as one means of solving the problem of retardation. Their purpose was to single out the children who could not do ordinary school work. These tests have been widely used both in Europe and America. In the Binet-Simon Scale there were fifty-four tests, ranging from the third year up to adults. In the United States the old Binet-Simon Scale has been much improved by Dr. Lewis M. Terman of Leland-Stanford, Jr., University, by Goddard, and by Kuhlmann. The Goddard Revision was published in 1910, Kuhlmann's in 1912 and 1922, Terman's in 1916. The Yerkes-Bridges-Hardwick Point Scale appeared in 1915 and Herring's in 1922. The Herring Revision, published by the World Book Company, is considered a very good individual examination of mental ability and is based on the original Binet-Simon Tests.

The *Stanford-Binet Scale* or the *Stanford Revision* comprises ninety tests and is the net result of testing many thousands of children and carefully tabulating the results. Write to Houghton

Mifflin Company for samples of these tests and for information concerning their use In the original (1911) Binet Scale the five tests for age five were as follows

1 Compares two weights
2 Copies a square
3 Repeats a sentence of ten syllables
4 Counts four pennies
5. Unites the halves of a divided rectangle

For the tenth year these five were used

1 Arranges five blocks in order of weight
2 Copies drawings from memory
3 Criticizes absurd statements
4 Answers difficult common-sense questions
5. Uses three given words in not more than two sentences

Teachers may secure any intelligence test published, and there are a score or more, by writing to C A Gregory Company, Cincinnati, Ohio

**Kinds of intelligence tests.** These tests are all either individual or group tests, another classification is into verbal and nonverbal or *performance* tests Originally intelligence tests were used mostly to determine low-grade mentalities, they were individual tests, which of course require much more time to administer Individual tests are, however, more exact but require greater skill on the part of the examiner When the World War came on it was found necessary to test very large numbers of soldiers, both literate and illiterate So the group intelligence tests, both verbal and nonverbal, were prepared at that time for this purpose and were used extensively In schools group intelligence tests have found a large place When necessary in exceptional cases, individual tests may and should also be used for more accurate measuring For examining large numbers of school children group tests are indispensable and they may be used successfully by any average teacher Both the testing and the scoring may be done quickly Both group tests and individual tests may be used with those who can read or under-

stand the given language and those who cannot In using verbal or language tests, the examinee must either be able to read or to understand the spoken words. At the time of the World War the *Beta* test was used with the illiterate, or those who could not read or understand English The verbal test was called the *Army Alpha* The nonlanguage or performance tests were early used by immigration officers These tests are standardized and provided with norms and time limits Sometimes pencil and paper are used and sometimes not. In using the *Army Beta* sometimes the directions were given by means of various actions and manual signs by the administrator

**Character or personality tests.** The student and teacher should study chapters 14 and 15 in Stroud's *Educational Psychology* [1] on the subjects of the Development of Personality and Studies in Personality This author discusses the various means which have been used and are now being employed to measure personality traits. Chapter 16 in *Human Behavior* by Colvin, Bagley, and Macdonald will also prove very suggestive in studying this problem This is a field in which many experiments are now being made and in which large numbers of tests, rating scales, and questionnaires have been devised It is impossible to test personality in a general way Personality is not an entity or a unitary something, instead, it is the sum total of a multitude of behavior characteristics and tendencies All that can be done is to secure samples of behavior responses There are now several tests of attitudes, of moral judgments, of interests, of a variety of conduct reactions, and other responses The results secured in personality tests are, as a rule, not so dependable as those of intelligence and achievement tests Nothing like the exactness of the diagnostic tests in school subjects has been obtained in the realm of character or personality testing The objective methods of the behaviorists have a most fruitful field in the study of the behavior manifestations of what we designate as human personality. The best character tests are those which measure the performance or conduct reactions under specified conditions

[1] STROUD, J B —*Educational Psychology*, The Macmillan Company 1935.

One of the greatest difficulties is to obtain true measurements of behavior under normal situations in which artificial or manufactured conditions have been reduced to a minimum

A number of years ago Paul F Voelker [1] endeavored to find out whether it is possible to measure the development of ideals and to determine the procedures needed for such development Most of the Voelker tests had to do with honesty This investigator came to the conclusion that certain forms of direct teaching as found in such young people's organizations as the Boy Scouts do have a definite bearing upon the development of the ideals and habits of honesty Symonds [2] gives a detailed account of the testing procedures which are used in the measurement of personality The principal means employed are those which involve directed and detailed observation of behavior responses through the use of questionnaires, performance tests, and the like Public schools in general are not using personality tests today nearly as much as they will, in all probability, during the next decade It is important for any teacher to be a student of personality, for the establishment of wholesome, socially useful, and effective personality attitudes, interests, ideals, and habits is really the main job, after all At the present time one of the conspicuous needs in the field of testing is a relatively reliable measure of the moral judgments and attitudes of children in order that teaching-learning procedures may be used to develop desirable character traits Undoubtedly many measures of various types will be necessary in this field, but certainly all of them will be limited to a measurement of behavior reactions; personality cannot be measured directly just as it is impossible to measure intelligence directly

**Accomplishment tests and ratios.** This topic might be worded "achievement tests and achievement quotients" The achievement or accomplishment quotient or ratio is found by dividing the subject, or achievement, or educational age by the pupil's

[1] VOELKER, P F—*The Function of Ideals in Social Education*, Bureau of Publications, Teachers College 1921

[2] SYMONDS, P M—*Diagnosing Personality and Conduct*, Century Company. 1931

mental age A child's "accomplishment quotient is the ratio of the child's actual accomplishment in a subject-matter test or group of tests to his general mental ability In other words, it shows the relationship of what the child actually does to what may reasonably be expected of him on the basis of his intelligence "[1]

Diagnostic tests, inventory tests, supervisory tests, prognosis tests, research tests, practice tests, subject tests and scales, instructional tests, quality, or product, and performance scales are all measures of a pupil's achievement or progress in schoolwork. The most useful measure of a teacher's instructional success is the *progress* of her pupils collectively and individually during a given period of time—a month, a term, or a year Such a measure is a true diagnostic instrument, because it reveals particular difficulties and makes clear what needs to be done both with dull and bright pupils

Achievement tests, including many achievement batteries (all subjects), such as the *New Stanford Achievement Test* both Primary and Advanced, Forms V, W, X, Y, Z, or the *New Metropolitan Tests,* are available for the use of any teacher. "Carefully derived age and grade norms, representative of school children throughout the country, are available " These have been obtained by giving tests to many thousands of children. The *Gates Primary Reading Tests* for the first two grades and the *Sangren-Woody Reading Test* for the five upper grades are good examples of modern achievement tests It takes about 70 minutes to administer the *Stanford Primary Test* and about 150 minutes for the *Advanced* The *Iowa Spelling Scale* or the *Morrison-McCall Spelling Scale* are good examples of scientific educational scales

A child with a high I Q should usually make better progress in schoolwork than one whose I Q is much lower. But this is not always the case; it happens not infrequently that a child of only moderate intelligence surpasses the brighter schoolmate,

[1] LINCOLN, E. A , AND WORKMAN, L L —*Testing and the Use of Test Results;* The Macmillan Company. 1935.

and for various reasons. Two important determining factors are health and industry Great brain capacity does not get us far in learning if there is lack of nervous energy or if there is a disposition to take life too easy Lincoln and Workman state that "It must be remembered, however, that achievement is not determined by ability alone. Interest, earnestness, motivation, and other significant things and conditions are all factors in achievement"

The accomplishment quotient for a given subject is found by dividing the subject age by the mental age For example, a pupil with a mental age of ten years and a subject age of twelve years in reading, has an accomplishment quotient in reading of 120 A pupil twelve years of age mentally may have a spelling age of only nine years. Then his accomplishment quotient in spelling is only 75. A child's general accomplishment quotient may be found by dividing his total educational age, the composite for all school subjects, by his mental age. If a child is doing normal work his general achievement quotient should be about 100 If this A Q is much below 100, the teacher should know the reasons back of the situation The authors of *Human Behavior*, already referred to, say that "Investigation tends to show in general that persons with slightly lower than normal intelligence accomplish more than their theoretical expectancy, while those with high I. Q.'s very seldom surpass their expectancy In other words, persons with I Q.'s slightly below 90 very often have A Q.'s above 100, while persons with high I. Q.'s very seldom have A. Q.'s above 100 and often fall below 100." Then the writers briefly consider the underlying causes, among which may be the fact that teachers give more attention to the duller pupils and are inclined to let the brighter ones shift for themselves

**Prognostic and aptitude tests.** A prognostic test is a form of the intelligence test characterized by test items which will enable the examiner to obtain a more or less accurate idea of what a child will be able to do in the future in one or more school subjects or in some particular field of study or activity.

The aptitude test, much used today in vocational guidance, is a form of the prognosis test which is intended to discover a person's special adaptability for some particular type of work or life activity Aptitude tests are used much more today in industrial circles than in schools Every good intelligence test is of course also a prognostic test, to some degree Today we have mechanical aptitude tests, such as the *Stenquist* musical aptitude tests, of which the *Seashore Test* is the best known, and others which have some predictive usefulness It is of course highly desirable, if it is possible, to be able to discover early in life what particular field of human endeavor or achievement a young person is best fitted for At the present time prognostic and aptitude tests are rather crude and inaccurate instruments of measurement, just as are the personality tests As always in the past, we find young people today drifting more or less aimlessly into trades and professions, although scientific vocational guidance in many school systems has accomplished a great deal to help young people find their proper places

**Practice or drill tests.** The name indicates the purpose of these tests. The *Courtis Standard Practice Tests in Arithmetic* have been widely used for many years. These practice tests are used in grades 4 to 8 and are well adapted to individualized instruction. The *Courtis* tests have to do with whole numbers; there are 48 graded lessons on cards First the pupil is tested to discover his individual needs and then the appropriate practice material is provided to secure the desired skills. Scientific practice tests are now available in several school subjects such as reading, arithmetic, and writing, and these tests are now standardized to furnish the necessary drill to overcome individual weaknesses The special value of such tests is that they are prepared with much exactness, are objective in character, and are provided with norms Besides the *Courtis* tests two other well-known practice tests in arithmetic are the *Lennes Test and Practice Sheets in Arithmetic* and the *Economy Practice Exercises in Whole Numbers* by Studebaker, Knight, and Ruch The *Gates-Peardon Practice Exercises in Reading*, and the *Leamer*

*Diagnostic Practice Sentences in Handwriting* are also good illustrations of modern practice tests Serviceable practice tests are based on the principle that children should not work on what they now know or can do, but rather that interesting and attentive repetition for developing specific skills should follow definite diagnosis of specific needs The first need is to find out what the pupil does not know and cannot do, then to apply the necessary remedial practice As much as possible, pupils should be prevented from making mistakes, and as far as may be the drill activities should be well motivated. That is to say, pupils should see the need for what they are doing and have a desire to do it Modern scientific practice tests disclose individual needs and provide practice to develop corresponding specific skills Rural teachers will now find that many workbooks published by several different companies provide today for rather exact diagnosis and also for suitably motivated remedial practice. The rural teacher needs reliable materials for individual instruction; she can profitably make use of good practice or drill tests It will pay any teacher to investigate the practical usefulness of drill tests The use of some of this commercial, standardized material will add much interest to school work and will also enable the teacher herself to acquire proper objectives and correct standards

**Instructional tests.** These are " tests used to aid in teaching, especially where some individualized instruction is used Tests are prepared for special units of the subject rather than for the subject as a whole . . Work books or practice exercises or instructional tests are carefully selected exercises grouped and arranged conveniently for drill purposes " [1] Sometimes these tests are published by book companies for use with a particular textbook and sometimes they are of a more general character and adapted to different texts and to a variety of courses of study. Publishers are, in some cases, printing these instructional tests in the regular textbook or in a workbook which accom-

[1] LINCOLN AND [illegible] The Macmillan Company. [illegible]

panies a particular text. One advantage of instructional tests, especially if they are adapted to a certain text, is that the teacher has at hand a convenient means of accurately measuring the actual accomplishments of individuals as the teaching and learning processes go forward. Pupils, themselves, are also able to judge of how well they know and can do the required work It seems likely that publishers will increasingly provide good tests as an essential element of a serviceable textbook in the subjects of the elementary school. Good instructional tests measure speed, accuracy, comprehension, organization, judgment, appreciation, memory, problem-solving ability, and other powers and abilities in arithmetic, language, reading, and other subjects

**Nature and use of scales.** Lincoln and Workman state that "a scale is (1) a test in which the items are arranged in order of difficulty, the increase in difficulty being equal for successive steps; (2) an instrument made up of carefully selected and graded samples of pupil performance, as a penmanship scale; (3) a series of lists of equally difficult items, as a spelling scale "

Two of these most widely used measures are the Ayres Scales—one *A Measuring Scale for Ability in Spelling* and the other *A Scale for Measuring the Quality of Handwriting of School Children.* A scale is a measuring standard or instrument by means of which the teacher may judge a pupil's finished product In the *Ayres Scale for Handwriting* eight samples are given, ranging from the poorest, with a value of 20, up to the best, with a value of 90 This is the Gettysburg Edition of the scale, and may be obtained by writing to the Russell Sage Foundation, New York City. In using the scale the teacher slides the pupil's writing along the scale until it comes to the particular quality which it most nearly resembles *Quality*, rather than *style* should be kept in mind, as the criterion or standard for comparison.

The *Ayres Scale for Ability in Spelling*, is published by the same Foundation and contains 1000 words arranged by grades Teachers should also get the monograph which accompanies the scale. "All the words in each column are of approximately equal

spelling difficulty The steps in spelling difficulty from each column to the next are approximately equal steps The numbers at the top indicate about what per cent of correct spellings may be expected among the children of the different grades For example, if twenty words from column *H* are given as a spelling test it may be expected that the average score for an entire second grade spelling then will be about 79% For a third grade it should be about 92%, for a fourth grade about 98%, and for a fifth grade about 100% "

Besides the Ayres scales in handwriting and spelling, *Thorndike's Handwriting Scale* is used extensively throughout the country We also have the *Freeman Chart for Diagnosing Faults in Handwriting* The *Buckingham Extension of the Ayres Spelling Scale* (1500 words) and the *Iowa Spelling Scales* for grades 2 to 8, a separate scale for each grade, are now well known Often it is of value for each pupil to have his own copy of the scale The *Morrison-McCall Spelling Scale* is a booklet of 16 pages containing eight spelling lists of 50 words each, for the use of the teacher

There are many scales now on the market in reading, spelling, arithmetic, handwriting, composition, and some other subjects *Woody's Arithmetic Scales* in the four fundamental rules are well known. The *Searchlight Problem Scales* or the *Buckingham Scale for Problems in Arithmetic* is made up of three divisions, of two forms, I and II, each The three divisions are for grades 3 and 4, 5 and 6, 7 and 8, respectively. The *Woody-McCall Mixed Fundamentals* is designed for grades 3 to 8, inclusive The *Hudelson Typical Composition Ability Scale* is adapted for grades 4 to 12, and is "an accurate instrument for the measurement of achievement and the classification of pupils The even grading of the samples makes it a scale easy to handle" It consists of a series of compositions carefully graded which serve as examples for composition writing The *Lewis English Composition Scales* are designed to measure attainment in letter writing The compositions used were written by school children in grades 3 to 12, under standard schoolroom conditions. The

*Willing Scale for Measuring Written Composition* is designed for grades 4 to 9, inclusive. The *Thorndike-McCall Reading Scales* are prepared for use in grades 2 to 12, inclusive, and the entire series has nine equivalent and interchangeable forms.

The directions on one composition scale are as follows: "Compare the quality of your composition with the quality of the samples on the scale Assign to your composition the numerical value of that evaluated sample which most nearly equals it in merit "[1] One writer states that "Teachers who use the composition scale will find themselves becoming more critical of the adequacy of the thought expressed in the compositions written by children, and possibly somewhat less concerned about the formal side of the work."[2] Every rural teacher should make use of writing, spelling, and composition scales at any rate. Standards for comparison, scientifically determined, are of great value to any teacher Quality or product scales really take the place of achievement tests in subjects where these cannot be used Modern scales are the result of extensive investigations and samplings of the work of pupils in all parts of the country. They have proved of much value to thousands of teachers

**Techniques in modern testing.** Every teacher today needs to understand the methods of modern testing and to have some skill in the administration of tests If possible, the young teacher should have at least a brief training course in tests and measurements. The essential principles of modern measurements are not difficult to master; no teacher is today fully equipped for her work without this necessary knowledge and skill

1 No teacher should attempt to give any intelligence or achievement test until she has read the directions carefully

2 Directions must be followed closely if the results are to be of much value Here is a case where ability to do exactly as required has a direct relation to the value of the net results

3 Teachers should learn how to give tests by watching others and by actually taking tests themselves. Then the learner

[1] HILLEGAS—*A Scale for the Measurement of Quality in English Compositions by Young People*

[2] STRAYER AND NORSWORTHY—*How to Teach*

should give the tests to pupils under the direction of some person who knows the technique.

4. Secure the *Thorndike-McCall Reading Scale*—for grade 5, let us say, and carefully read the directions They are very explicit and are in themselves a good test in silent-reading abilities Part of the directions are for the pupil and part are for the teacher. The directions in the *Haggerty Reading Examinations*, the *Sangren-Woody Reading Tests*, the *Gates* or the *Pressy* tests, or in many others will illustrate the point just as well, so far as reading tests are concerned.

5. Tests are scored in a variety of ways, full directions accompany the test in every case Keys are furnished with the tests, giving all possible correct answers if in any case there is more than one, these keys are used in scoring, thus making the results very exact Read carefully the rules for scoring the *Otis Self-Administering Test of Mental Ability*, Intermediate Examination, any one of the four forms. Then administer the test to a group of children or adults

6 After the papers are scored the results are tabulated The form of the tabulation is determined by the purpose of the test In general, the facts should be presented so clearly that it will be relatively easy to make comparisons, showing the departures from the normal standards by individuals and by groups of pupils Get one of the *New Stanford Achievement Tests* There are five forms each for the Primary Examination, grades 2 and 3, and for the Advanced Examination, grades 4 to 9. The teacher needs the manual of directions, perhaps the guide for interpreting, and the school summary record Not too much time should be spent on tabulations, but it is always necessary to compute the measures of central tendency, particularly the median scores Then these scores should always be compared with the established norms

7. The correct interpretation of the results of any test is an important matter Interpretation has to do both with the group as a whole and with the individual In order skillfully to take the readings, make the diagnosis, and suggest the remedy, ex-

pert interpretation may be needed It may be clear that the grade of mentality of a given pupil is so low that he can never, by any possibility, complete the eight grades In the case of another boy, his I. Q is 120, but his A Q is only 85 Here correct interpretation will disclose causes and remedies If scores are either very low or very high the teacher can often explain the situation because of her intimate acquaintance with her pupils The chief value of tests lies in their diagnostic uses for remedial purposes

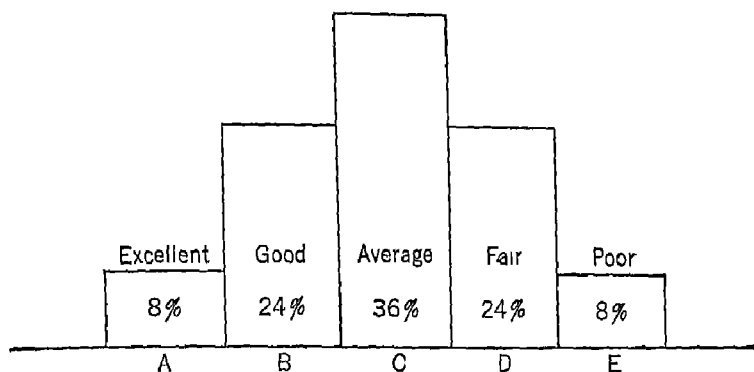
8 Tests should be repeated as often as the needs of the pupils and of the teacher require

9. The teacher should aim to get and to keep a given child up to as high a level of attainment or accomplishment as his native capacities will warrant and permit In order that a pupil may move on at his normal rate of progress the teacher must test him repeatedly to discover how much he is gaining

10 Some tests will need to be repeated weekly, some once a month or once a term The time factor should not decide this matter, but rather the child's mastery of the subject matter and the skill which he attains When certain combinations have been taught and drilled upon, the teacher will need to test to ascertain the results of the teaching and drill.

11 Intelligence tests may not need to be repeated more than once each year, using a different type and form of test each time; but achievement tests should be given frequently if the teacher is to avoid guessing and to keep herself and her pupils up to standard effort and progress Diagnostic and practice tests are of course in daily use in the best schools The teacher certainly needs to make constant use of reliable scales where they are applicable New-type, objective tests should be used constantly Testing is an essential part of the instructional program of the school, and varied testing is always in order when needed

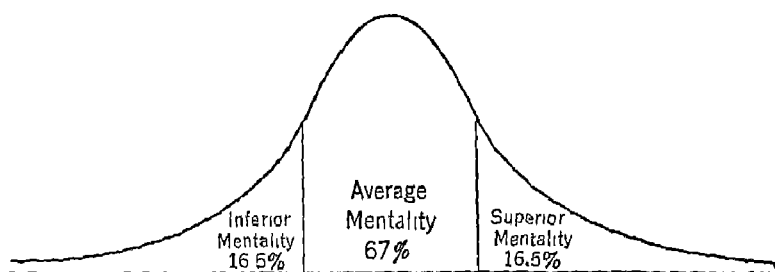
**Normal and skewed curves of distribution.** When intelligence or achievement tests are given to large, unselected groups of children or adults, it is found that the results indicate a distribu-

tion of abilities which will approximate what is called a *normal distribution curve* Instead of a grouping of individuals into good and bad, bright and dull, and the like, it is always found, in large and *unselected* groups, that there is a good-sized middle or average number and a grading down to the very good and the very weak on either side It is quite common at the present time, particularly in secondary schools and colleges, to use the letters A, B, C, D, E, instead of per cent marks, to designate the grades of students. To illustrate, as a result of any given examination,

**Graph of Normal Distribution**

the members of a class of one hundred students of varying ability, might be arranged approximately as shown in the graph above.

It should be emphasized that such a normal distribution does not occur with this uniformity unless the numbers are relatively large and are of miscellaneous abilities The regularity shown in the above graph is of course very unusual If a list of words suitable to fourth-grade ability is given to an ordinary eighth-grade class, the above distribution of results does not obtain, because the *group is selected.* In the supposed case of the spelling test we would have a most decidedly *skewed* curve

From the following diagram it is seen that about two thirds of any large and mixed group of either children or adults possess medium-grade intelligence, about one-sixth high-grade mentality,

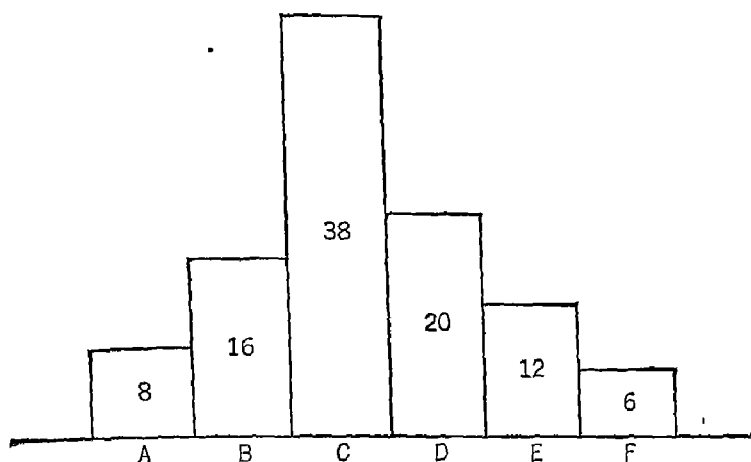
and about one-sixth low-grade mentality. About two individuals out of three in any average good-sized group are of average or medium-grade mentality or intelligence Here we have a good illustration of the normal distribution curve, it applies to the results of achievement tests equally well when there are large unselected groups

The Normal Curve of Distribution

Let us suppose that a class of one hundred high-school freshmen, taken from ten different high schools, is given a standard test in common and decimal fractions and that we wish to tabulate the results and to graph the distribution curve. The following chart and diagram will be needed first of all

| | | RESULTS OF THE TEST IN FRACTIONS | |
|---|---|---|---|
| A | 95 to 100 | 5 + 1 + 1 + 1 | 8 |
| B | 90 to 95 | 5 + 5 + 5 + 1 | 16 |
| C | 85 to 90 | 10 + 10 + 10 + 5 + 1 + 1 + 1 | 38 |
| D | 80 to 85 | 10 + 5 + 5 | 20 |
| E | 75 to 80 | 5 + 5 + 1 + 1 | 12 |
| F | Below 75 | 5 + 1 | 6 |
| | | Total | 100 |

This chart is self-explanatory Eight students did excellent work, and six students failed Why did they fail? Approximately

three fourths of the class did work between 80 and 95 per cent

When the number of scores for each group shown in the above distribution chart are graphed, they appear thus

**Average Distribution of One Hundred Students**

Teachers will find that by the use of distribution tables and graphs they will get a clearer understanding and appreciation of the work they are doing and of the relative progress of their pupils With some teachers, instead of an approximation to the normal distribution curve there may be either too many with very high marks or too many with the other extreme Such a situation needs to be analyzed Teachers should bear in mind that not every class shows a normal distribution in every test In fact, a skewed distribution is very common The type of subject matter, the character of the test, the ability of the teacher, and the ability of the members of the class will all, of course, have large influence. The results of one test may show a fairly normal distribution, in the next test the curve may be greatly skewed to the right, and in the third test the skewing to the left may be as decided as it was formerly to the right In fact, in most classes the results of any test will disclose a de-

parture from the normal of greater or less degree The larger the group tested and the more miscellaneous the abilities, the more nearly will one get a normal curve of distribution of scores

**Indications of central tendencies.** By central tendency we mean some general, average, middle value or measure of a number of scores or marks representing the individual achievements of an entire group Usually we think of the *average* of the series, found by dividing the sum by the number of cases It has been and is common to get the average or arithmetical mean of the scores secured in any sort of an intelligence, achievement, or other test as *one* measure of the central tendency of the class. The three common measures of central tendency are the mean, the median, and the mode The median score of a number of scores is simply that score which has the same number of scores above it as there are below it The median in most cases is a truer measure of central tendency than the mean, or average, because it is usually less affected by the very high and the very low scores. In some cases the mean and the median scores are approximately the same in value, when that is true either may be used as of about equal validity.

In obtaining the median score the results are arranged first in order from the lowest to the highest, and the median is the middle one of the lot In the following series of per cent marks, arranged in order of size, 73 is the median mark· 60–61–70–71–72–*73*–84–89–95–96–98 It should be noted that the median is not the arithmetical mean. The mean of this set of marks is 79 Note that five pupils did better than 73 and five did not do as well as 73 If there is an even number of scores the simplest, though possibly not the most mathematically correct, method is to take the average of the marks in the exact middle, for the median For example, if we make slight changes in the above list of marks, and add one mark, we have 60–61–61–70–71–*73*–*75*–84–89–95–96–98. The median is now *74*, the average of 73 and 75 In this latter case the mean becomes 77¾

Let us suppose that a class of twenty-five pupils is given a certain reasoning test in which there are 12 problems The class

is allowed fifteen minutes When the time is up the papers are collected and scored with the following results

| | | |
|---|---|---|
| *Number of Problems* | 4—5—6—7—8—9—12 | Total 51 |
| *Number of Pupils* | 2—1—6—8—5—2— 1 | Total 25 |

These figures mean that two pupils solved four problems correctly, one solved five correctly, six solved six correctly, and so on through the entire class The twenty-five pupils solved 175 problems, which is exactly an average of seven problems each. In this case the median point is somewhat more than seven, if computed very accurately However, the midmost number is also seven, with three sevens above and four sevens below the middle number, ranging from 4 at the top to 12 at the bottom Figuring on a 100 per cent basis, the average or mean per cent score of the above twenty-five is 58.3+ and the median per cent score is also 58 3, determined by taking the thirteenth score from either the top or the bottom.

Formerly teachers were content to secure the arithmetical mean in all cases In any series of per cent standings such a mean may disclose the central tendency of the class, and again it may not If the teacher desires to find a type result for purposes of comparison, the median is more useful than the mean for this purpose In the above illustration the median point is approximately 7½ problems The score made by the largest number of pupils in a frequency distribution is called the *mode* In the above illustration the mode, or *modal point*, is seven problems worked correctly It is impossible, of course, in this text, to go at all deeply into the mathematical phase of measurements In fact, for the average teacher, certainly the rural teacher, there is no need for any complicated computation It will be confusing and will usually have but little educational value. Leave the higher mathematics to the specialists

**Comparison of traits and abilities.** Suppose that we wish to compare the abilities of an individual or of a class, in let us say spelling and reading For example, what is the relationship between the silent reading skills of a given fifth-grade class and the

ability of the same class to spell words of average fifth-grade difficulty? The measure of resemblance between the reading and the spelling abilities of the fifth-grade class we designate as the *correlation* If the pupils spell about as well as they read we say that there is a close or a positive correlation so far as these subjects are concerned It may be about +0 90, for example If the pupils are extraordinary spellers and very poor readers, or vice versa, the correlation may be say +0 25 The coefficient of correlation is the decimal expressing the relationship between the abilities or traits, and ranging from plus 1 0 through 0 to minus 1 0 If the ability or skill of the fifth grade in spelling and reading is precisely the same, which is very unlikely to be the case, the coefficient of correlation would be +1 0 If they can spell twice as well as they can read or if they can read twice as well as they can spell, the coefficient of correlation is +0 50. The coefficient of correlation is represented by the letter *r* Stroud says that the correlation between intelligence test scores and school grades is about 0 50, on an average; this author suggests that the reason for this low correlation is that measures of intelligence are far from being exact and, moreover, that the grades given to pupils by teachers cannot be entirely accurate measures of their achievements or progress, even under the best of conditions There is quite a close correlation between the scores obtained by the use of different intelligence tests, providing these tests are all made scientifically and then standardized The author has repeatedly found a close positive correlation between the results of the *New Stanford Achievement Test*, Advanced Examination (which is a large battery of tests), and the *Otis Self-Administering Test of Mental Ability* There is a close positive correlation between a high I Q and general ability to learn There may, however, be a low correlation between the general intelligence and the social intelligence of, let us say, a thousand high-school seniors In the very important matter of personality, Gates states that, "on the average, weakness in one trait implies weakness in others, mediocrity in one implies mediocrity in others, and strength in one strength in others."

But while no doubt there exists this close positive correlation, there are notable and not uncommon exceptions

## REVIEW, TEST, AND PROBLEM EXERCISES

1 Make out a testing program for a rural school of thirty pupils, one half of them in the first four grades. Name the different tests, find where they can be obtained, and compute the total cost Include intelligence tests, batteries of achievement tests, diagnostic tests, practice tests, and scales

2 Draw up a plan by which you can set down some systematic record of each child's personality There should be spaces for indicating changes and developments from time to time Name all the different means available to a rural teacher by which she can estimate pupil personality

3 Let us suppose that a class of fifty eighth-grade pupils are given a test of twenty problems to measure their reasoning ability No pupil works less than five correctly, and some pupils do from fifteen to twenty problems Assume numbers of pupils for different numbers of problems, from five to twenty Tabulate, make a graph, compute the median and the mean

4 Give intelligence tests and achievement tests, *i e*, a battery, to a group of grade pupils. Compute the I Q 's and the A Q 's and then determine the correlations for each child and for the entire group.

5 Make out a set of twenty-five old-type, essay examination questions based on a three-months' study of the Colonial Period of American History. Arrange to give each question approximately the same weight and make sure that each answer can be expressed in from 100 to 200 words Then make out a guide or key for scoring so that the subjective element will be reduced to the minimum In other words, make the test as objective in character as possible.

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# CHAPTER XXVI

## PROBLEMS OF TESTING AND EXAMINATION

The last two chapters in this book dealing with (*a*) modern mental and educational measurements and (*b*) tests and examinations are interdependent and mutually supplemental. The subject of measurement in education is of great importance and has had a remarkable development during the past twenty years. The use of subjective *opinions* in the testing of teaching and learning is gradually giving way to *scientific measures* of a more objective character by which educational results are more accurately judged and measured than ever before. In Chapter XXV considerable attention was given to mental measures and to the formal educational or achievement tests. This last chapter has to do with many practical everyday problems in the general field of testing, such, for example, as making out test or examination questions and marking papers. The purpose of the present chapter is to present some of the more specific and definite details which the average rural teacher must take into account in the field of testing if she is to be successful. Much time and effort is often wasted, or worse than wasted, in the attempt to conduct tests of doubtful validity or educational usefulness. Tests and examinations are chiefly useful to rural teachers and to all teachers as a means of carrying on the necessary activities of teaching, studying, and learning. The *main* function of examinations is not that of securing a mark for record, classification, or promotion purposes.

**Why have examinations and tests.** There are many excellent reasons why the school should make use of a great variety of testing processes; there is not room to give them all here. The young teacher and student should read such books as Lang's *Modern Methods in Written Examinations*, Lincoln and Work-

man's *Testing and the Use of Test Results,* Yoakam and Simpson's *An Introduction to Teaching and Learning;* Crawford's *The Technique of Study,* Madsen's *Educational Measurement in the Elementary Grades,* and several others in order to understand the real functions of tests and examinations The great purpose of tests is to promote more effective study and learning The teacher must test in order to know what to teach; the pupil must be tested so that there will be a point of departure for further learning A teacher makes use of pretests to find out what the pupil now knows and can do. This furnishes the basis for further teaching, studying, and learning. After pupils have studied, the teacher gives a mastery test to discover the exact status of the pupil's learning. The diagnostic test is the most useful of all tests from the standpoint of learning. Ruediger in his *Teaching Procedures* gives four purposes of tests. (1) diagnosis, (2) information to parents, (3) classification, promotion, etc ; (4) educational and vocational guidance Teachers test to motivate and stimulate effort, to discover teaching weaknesses, to review, to develop a better learning attitude; to supply learning situations; to furnish a record and report card mark; to train pupils in working to overcome difficulties, to give special practice in written language, to check the extent and the quality of various readings, and for a number of other purposes

**Educative values of examinations.** In considering the uses of tests there are many factors to take into the account For example, the age and the grade have a vital bearing on the problem In this topic only children of the upper grades are contemplated; any formal examinations in any case for lower-grade pupils are of course out of the question For the older pupils a good examination acts as a stimulant and an incentive. The effect of a proper type of test given under favorable conditions is altogether wholesome. A test of the right sort impels a pupil to make the effort necessary to answer the questions He cannot waste his time if he is to be successful So through correct tests he learns to apply his mind without delay This is a very useful habit for the school to establish. Further, if the teacher

knows her procedures and is a good manager, she will see to it that pupils do their best on *all* tests The tendency to hurry through with doubtful answers must be discouraged at all times. Tests carelessly worked out should not be tolerated Pupils must learn to be particular and as accurate as possible A good test properly conducted makes for a habit of careful thinking The essay type of examination calls for organization of materials, also, this is a valuable ability and habit for the school to develop in pupils Through good examinations pupils learn to choose between important, central facts and unimportant or subsidiary items of knowledge And again, suitable examinations develop habits of self-reliance and self-control The pupil must depend on himself and use all of his mental resources if he is to produce a creditable result Good essay examinations are also highly desirable exercises in written composition and should be so considered Through such examinations children gradually learn to set their thoughts down in good order; thus the ability to use written language is developed.

**Attributes of an adequate test.** In the preceding chapter the teacher and student will find an enumeration and discussion of the marks of a scientific test It is enough to say here that any test, whether standardized or not, formal or informal, objective or of the essay variety, should either accomplish certain definite purposes or not be used at all A good test reveals certain conditions of knowledge and ability If it is a diagnostic test it is so constructed that it will give exact, detailed, and specific information of a pupil's abilities and deficiencies or weaknesses A proper test can be depended upon to show what it was intended to discover If a teacher asks her pupils to enumerate the direct and the indirect causes of the Revolutionary War, the answer is plain. If a child of a given grade is given an example in long division of a certain degree of difficulty and if there is a certain time limit, determined by established standards or norms, the conditions are present for discovering what this child can do If instead of an example, a problem involving the four fundamental rules is given and a time limit is again set, another

ability will be tested A good test is carefully graded and adapted to the child's stage of advancement It is interesting, it causes the child to put forth his best efforts A good test question of the essay type is neither too hard nor too difficult It is definitely limited in its scope Too often tests are vague and uncertain because the teacher does not have precise objectives Adequate tests are carefully graded and weighted; they are clear, concise, definite, interesting, dependable, adapted to the child's knowledge and ability, of proper length, useful, accurate, limited in scope, and designed to accomplish particular teaching-learning purposes

**Types of tests and examinations.** Lincoln and Workman enumerate five definite kinds of tests (1) Achievement or accomplishment, (2) Intelligence, (3) Character or personality; (4) Prognosis; and (5) Practice or drill These writers include speed and power tests as well as diagnostic tests under achievement tests They also class the aptitude test as a kind of prognosis test, which of course it is

There are many bases for making a classification of tests. All tests are either oral or written, standardized or nonstandardized, objective or essay, formal or informal, mental (intelligence) or educational (mostly achievement tests). Standardized tests are either group tests or individual tests Educational tests are either formal and standardized, informal and objective, or essay The teacher and student should read the discussions of testing and measuring in Yoakam and Simpson's *An Introduction to Teaching and Learning* or in Adams and Taylor's *An Introduction to Education and the Teaching Process* in order to get a general survey of types of tests.

Of the new-type objective tests there are completion tests, true-false tests, multiple-response tests, matching and identification tests, and others. We now have power tests, speed tests, instructional tests, association tests, problem-solving tests, survey tests, vocational-guidance tests, mechanical-ability tests, performance tests, and many others We have scales in great variety, particularly handwriting and spelling scales. Tests are

now used to realize many different educational aims and may best be grouped according to what they are intended to accomplish

**Value of old-type essay examination.** There are many teachers today who are using the new-type objective test almost exclusively The writer believes that to be a mistake Unless pupils are also given repeated and frequent opportunity to answer questions calling for organized thinking, they will be deprived of a valuable means of learning The essay examination furnishes such opportunity and should be used for that purpose, at least Let us freely grant that the old-type examination has many defects The questions are often made out in a hurry and are entirely inadequate The grading of the papers is necessarily inaccurate and more or less unfair To grade answers of that kind and do it justly is often very difficult Nevertheless, it is also true that the objective tests used by many teachers are not of a very high grade They often call for unimportant, irrelevant, useless details—the mere lumber of the textbooks They can of course be scored objectively and accurately. However, every rural teacher should make frequent use of essay-type examinations in order to train pupils in the use of written language forms, in composition, and in the ability to grasp, retain, and present entire topics of subject matter. Such test papers should be prepared very carefully, of course With upper grade pupils, in such subjects as geography, history, civics, physiology, agriculture, and nature study, there are many occasions when a short, carefully prepared essay examination is not only proper but highly desirable Many more illustrative questions could be given Questions must be prepared with great care and the test conducted under good conditions It is of course very true that in all of the subjects named objective tests may also be used with great advantage, but they should not be used as the only means of testing

Below are given some of the usual types of essay-examination questions, using the language which has had common acceptance, but which may be greatly modified to suit conditions and circumstances

1 Explain the construction and operation of the Babcock Milk Test.

2. Summarize the results of the French and Indian War.

3. Outline the system of federal courts.

4. Illustrate the effect of climate upon the occupations of people

5. Discuss the methods of maintaining fertility of the soil on the average general-purpose farm in the middle western states.

6. Compare general living conditions in rural Sweden with those of rural Argentina.

7. Review the subject of verbs, giving the necessary definitions.

8. Describe the method of harvesting and threshing grain on a very large wheat ranch in the West

9 Classify nouns and pronouns, and give three illustrations of each class

10. Justify Lincoln's attitude on the Reconstruction of the South

If the teacher and student will carefully consider the answers to these ten questions, or better, write out satisfactory answers, it will be seen that the difficulty of justly grading such responses is indeed very great, in most instances.

**New-type objective tests.** The teacher and student will find samples of the new-type tests in the author's *The Country Teacher at Work* In the next topic samples of these objective tests are given for the benefit of those who may use this text Objective tests are now very generally used in elementary schools, secondary schools, colleges, and universities. In *The Country Teacher at Work* the student will find a discussion of the advantages and the limitations of the new-type tests as well as general suggestions for conducting such tests The obvious uses and benefits of new-type objective tests are as follows:

1. They are interesting; pupils as a rule enjoy writing the answers and aiding with the scoring

2. They are accurate. Scoring is done objectively and without guessing

3 They are often standardized. This means that both teacher and pupils are able to use a truly scientific measure The standard test is provided with norms or standard scores.

4. They can be made comprehensive in scope so that the teacher will be able to secure a much greater variety and a better quality of responses indicating the pupil's knowledge and ability than she can by using the traditional examination.

5. They are stimulating and are thus useful in motivating the study activities of pupils

6. They do away largely with the uncertainties, the dishonesties, and the guessing commonly associated with essay examinations

7 The making of good objective tests has a most salutary effect on the teacher. She must study and think in order to prepare good questions

8. They can be given frequently because they need not take much time

9 Pupils can often help in the scoring, usually during a portion of a class period.

10 The use of commercial, standard tests is an exact, scientific procedure which usually has a wholesome educational influence on teacher and pupils

**Samples of new-type tests.**

1 *True-false tests.* Underline *T* or *F*, cross out the other letter.

*a.* Burgoyne was a general in the Civil War (*T-F*)

*b.* Japan imports large quantities of silk from the United States. (*T-F*)

*c* Percentage means by the hundred (*T-F*)

*d.* John Quincy Adams signed the Declaration of Independence. (*T-F*)

*e.* The burdock is a perennial plant (*T-F*)

*f* The heart is larger than the liver (*T-F*)

*g.* The twentieth amendment has to do with woman suffrage (*T-F*)

*h.* The noun *news* takes a plural predicate. (*T-F*)

*i.* The Vice President is an ex officio member of the Cabinet. (*T-F*)

2 *Matching tests.* Place the appropriate letter (*a*, *b*, or *c*, etc.) in each blank.

| | |
|---|---|
| ______ 2000 pounds | *a* 36 square miles |
| ______ 4 pecks | *b* 160 square rods |
| ______ 366 days | *c* 320 rods |
| ______ a cubic yard | *d* a gallon |
| ______ 60 pounds | *e.* a ton |
| ______ one acre | *f* a barrel |
| ______ one mile | *g* a bushel |
| ______ 4 quarts | *h.* 640 square rods |
| ______ a township | *i.* a bushel of corn |
| ______ 1 gross | *j.* 27 cubic feet |
| | *k.* 12 dozen |
| | *l* a bushel of potatoes |
| | *m* a leap year |

3 *One-choice recognition tests.* Underline the expressions in the parenthesis that make the statements true

*a.* (Cartier, De Soto, Balboa) discovered the Pacific Ocean

*b* The largest city on the Great Lakes is (Cleveland, Chicago, Milwaukee, Toledo).

*c.* (Moscow, Canton, Tokio, Peking, Yokohama) is the capital of Japan.

*d.* There are (60, 32, 48, 96, 70) pounds in a bushel of wheat

*e.* The term of a United States senator is (2, 4, 6, 8) years.

*f* The pylorus is found in the (liver, lungs, stomach, spleen, heart).

*g* Saratoga was a battle in the (Civil War, World War, Revolutionary War, Spanish-American War).

*h.* Red clover is (a grass, a grain, a legume, a tuber).

*i.* An adjective modifies (a noun, a verb, an adverb, a preposition).

4 *Completion tests.* Complete the following statements

*a.* The three largest cities in the United States are ________, ________, and ________

*b.* The greatest meat-packing center in the world is ________.

*c* Paris is located on the ________ River.

*d.* The President during the War of 1812 was ________

*e.* The superintendent of public schools in my state is ________.

*f.* The freezing point on a Fahrenheit thermometer is ________.

*g* The Vice President of the United States is ________

*h.* The distance in miles around a section of land is ________.

*i.* The number of acres in a township is ________.

*j* The lake on which Cleveland is located is ________

5. *Single-expression response tests*

*a.* Which was the greatest battle of the World War? ________

*b.* How many oceans are there? ________

*c.* With what instrument do we measure air pressure? ________

*d.* How many feet are in a mile? ________

*e* To which class of forage crops does alfalfa belong? ________

*f.* What kind of government has Switzerland? ________

*g.* How many justices are in the United States Supreme Court? ________

*h* Which organ of the body makes gastric juice? ________

*i.* A predicate is always what part of speech? ________

*j* What is the capital of Brazil? ________

6 *Multiple-choice recognition tests.*

*a* Underline cities which are *not* capitals of states Boise, Sacramento, San Francisco, Chicago, Albany, Madison, Milwaukee, Denver, Cleveland, Detroit, Lincoln, Helena, New Orleans, Toledo, Buffalo, Baltimore, Frankfort, Nashville, Louisville, Topeka, Little Rock, Atlanta.

*b.* Underline perennial weeds ragweed, quack grass, burdock, purslane, Canada thistle, dandelion, wild parsnip, pigweed, plantain, oxeye daisy, mullein, mayweed, sorrel, curled dock, mallow, bull thistle, wild oats, pigeon grass, morning glory, wild mustard

7. *Analogy tests.* Insert phrases or words in the blank spaces so as to make true statements

*a* The Japan Stream is to the Pacific Ocean as the ________ is to the ________

*b* The mayor is to a ________ as the ________ is to a county or the governor is to a ________

*c.* The Panama Canal is to North and South America as the ________ ________ is to ________, Asia, and ________

*d* The backbone of a man may be compared to the ________ of a tree.

*e* The city of Washington is to the United States as ________ is to Russia

*f* Hawthorne, Irving, Edna Ferber, Lowell, Holmes, Willa Cather are grouped together by the common bond of ________

*g* Gastric juice is to the ________ as ________ is to the mouth.

*h* As decimals are written to the ________ of the decimal point so ________ ________ are written to the ________.

**Open-book examinations.** Study activities of pupils are determined by the objectives and the standards which control the thinking and the procedures of the teacher If the teacher stresses memory results only, her pupils in their study will govern themselves accordingly. If a teacher makes much of problem solving, the children will gradually learn to use facts wherever found for the solution of problems They will be continually on the lookout for problems and for data which will aid in drawing conclusions. The teacher determines very largely pupil activity and proportion and emphasis in study by the character of her questions and her directions.

For many years the author made use of open-book examinations as a part of his general testing system together with a variety of objective tests, both standardized and commercial, and many homemade tests Such tests were often formulated by the students themselves as a part of their preparation The open-book examinations at the close of a course were given sufficient time, so that the educational results were valuable and

definite Clear and specific directions were made out for the conduct of these examinations; the questions were formulated with care and with certain learning aims in view.

By the use of open-book examinations as a part of the general testing program many of the objections to the old-time essay examinations are eliminated. There is but little opportunity for nervous dread and fear of failure, which has been and is so common and so harmful Moreover, the occasion and the temptation to resort to dishonest practices is for the most part removed As pupils are permitted and encouraged to use all sorts of reference books freely and as there is no demand for the mere reproduction of factual material, pupils feel at ease and are in a mental and physical condition to put forth their best efforts.

The writer has found that by a judicious use of open-book examinations pupils do much more purposeful and more selective reading. The questions are framed to stimulate research and the acquisition of facts to substantiate a point or a proposition Facts are stressed in their relation to thinking and not in isolation regardless of relevancy and usefulness. Pupils learn by this method to make serviceable outlines and to marshal their material for the accomplishment of worthy ends The writer has frequently observed students as they have worked on this type of examination; he believes that the net results have for the most part been very salutary from an educational point of view as well as for their bearing upon change of personality and development of character

Sometimes the questions call for summaries, sometimes for the arrangement of propositions in an indicated order, sometimes for the use of indexes, sometimes for definitely prescribed use of dictionaries and encyclopedias, sometimes for an original developed paragraph, sometimes for the assemblying of data concerning a field of investigation, and so on It was a common practice with the writer to take one or more class periods during which the content and the management of the prospective examination were freely discussed Explicit written directions

were given and strict observance was required. Such a procedure is in itself of much educational value The exact reference books were named and the portions to be used were specifically indicated Throughout the course pupils were consciously thinking of the day when the final paper was to be prepared, some of the daily or weekly assignments found a place in the open-book examination Usually students were given the better part of a day to write the paper which concluded the work of the course It should go without saying that such an examination should not be used as the only criterion for judging a pupil's mastery of a unit or of a series of related units However, a first-class open-book examination is a genuine learning activity of much value; moreover, it is a more just and adequate test of knowledge, ability, and personal accomplishment than the old-time, unannounced, often stereotyped, ten-question, reproductive test, with its evil accompaniments of emotional upset and moral temptation

The following are a few of the types of questions which may be suitable for such an examination

1 Prepare a set of examples in long division, arranging them in order of difficulty

2. Write a detailed outline of the subject of milk—its production, care, distribution, and products.

3. Using any available dictionaries, write out the definitions of twenty words which have come into common use in the past twenty years. Be prepared to define these words orally, so as to show their meanings. Do not memorize

4 Prepare ten problems which will illustrate the four fundamental operations in common fractions Indicate the steps in the solution of your problems

5. Write a one- to two-page summary of the main points studied in the history class during the past month.

6 Using any available reference materials, make a good outline of *corn* from the farmer's point of view.

7. (*a*) Make an outline of sentences and write a definition of each kind (*b*) Do the same for the eight parts of speech

8 Prepare a useful ten-point bibliography on the subject of the Civil War, using any available references.

9 Look up the following words, indicate their pronunciation, and be ready to pronounce them (Here follows a list of 20 words commonly mispronounced )

10 Make out a list of essential equipment for an average rural school. Compute the cost by using your catalogue of school supplies.

11 Make out a 50-item true-false test on the physical geography of Europe

**Teaching—learning—testing.** The function of the teacher is to teach in order that pupils may learn Much learning takes place, however, without any teaching activity whatever The brighter pupils often teach themselves; that is, they furnish their own learning situations and conditions and then proceed to learn regardless of external effort or lack of effort to teach them It was common at one time to use the terms instruct, drill, and test, it was stated that the function of education in school or elsewhere was to instruct, to train, and to inspire children and young people It was thought that the result of instruction was knowledge, of training, skill, and of inspiration, character Today, we are stressing the manifold ways in which children *learn* Schools are arranging multitudes of more or less well-motivated learning situations. The modern emphasis is upon *learning* The great function of the teacher is to guide and direct and to furnish adequate occasions for learning. The best teaching is found in this guiding, directing, and providing of adequate learning situations But after a teacher has done her best to teach and after pupils have engaged in learning activities of whatever nature, there still remains the duty of the teacher to find out the net results of the teaching and the learning. Has the teacher succeeded? Have the children really learned? The only way to find out is to use the various testing procedures, of which there are very many Assign, teach, direct, guide, study, drill, learn; then find out the results in knowledge, ability, skill, or appreciation by some testing process adapted to the particular learning product How well can a child add when the sums are not more than 10? Test him. Does the class know the physical geography of Africa? Make out some test questions and find out.

Can Mary write a paragraph on what is found on a weather map? Have her write one and find out, or make use of an actual map. Can John spell ten required words? Have him write them from dictation or from memory Can Jane sing the song of the morning? The only way is to have her sing and to discover the exact situation Does this class appreciate the significance of "The Angelus"? Ask some questions calling for appreciation. Note that the type of test is determined by the particular learning to be tested To call for an enumeration of the objects seen in "The Angelus" would hardly be a test of appreciation.

**What learnings can be measured?** Learning produces changes in the individual, the purpose of tests is to discover what changes have taken place and to what extent It is possible now to measure mentality and achievement, the most recent pronouncement of the psychologists is that, in any event and in every case, all that we really measure with the best instruments yet devised is what has been acquired by experience, that is, what anyone, child or adult, has learned up to the time of the testing by his behavior or reaction to his environment When we measure we get a sample of the person's behavior We cannot measure mind directly All we measure is performance or reaction under certain conditions or circumstances. For the most part all tests measure knowledge acquired, this means chiefly the memory products retained Testing to find out what a child knows about geography, history, arithmetic, etc, is the most common form of testing. However, we can also test to find out what a pupil can do as well as what he knows If we wish to find out if a child can add mixed numbers, we try him out with such examples If we desire to test a child's problem-solving ability in any subject on a given level of attainment, we use the appropriate tests We can find out today very easily and accurately what is the child's comprehension and speed in silent reading If we wish to know how well he can read a poem aloud, obviously our test will consist in furnishing an opportunity for such oral reading We can test for mechanical aptitude, for musical aptitude, for social intelligence, for abstract intelli-

gence, and for aptitude in special school subjects. We can test for every type of skill in reading, arithmetic, handwriting, drawing; we can find out about a child's ability to solve problems in geography, in civics, in history, in arithmetic. Today through reaction and performance tests we can learn much about personality traits. At the present time it is possible to measure a great many and a great variety of learnings.

**Overdoing the business of testing.** There is abundant evidence that many teachers think chiefly of their work in terms of testing. The traditional recitation was and is today largely a testing exercise, although we now know that the so-called recitation period should be used chiefly as a teaching and learning opportunity and activity. It is quite possible for teachers to overdo both oral and written testing. In probably the majority of rural schools today the teacher assigns textbook lessons, usually in a single text, then, after the pupils have made futile and entirely ineffective efforts to learn little-understood lessons, they are called to the recitation seats where the teacher goes through the rather sorry and ridiculous procedure of testing for knowledge which the pupils do not yet possess. Teachers seem to delight in asking testing questions, both oral and written, when their time might better be spent in directing study and learning activities. They often test when there is no need for it. They seem to feel that they must test for every bit of factual material found in the text. Such is not the case. More time should be spent on teaching, which may well be interpreted to mean making provision for stimulating learning situations. By the use of first-class objective tests, the time devoted to testing may be greatly reduced. The main work of the school is to have children study skillfully and learn certainly and fruitfully.

**Special values of diagnostic tests.** If a rural teacher wishes to know the real value of diagnostic tests in arithmetic, for example, she should write to Scott, Foresman and Company of Chicago for their *Compass Diagnostic Arithmetic Tests* or to the Public School Publishing Company of Bloomington, Illinois, for the *Osburn Inventory Tests in Arithmetic*. Of course there are

many others Write to the World Book Company, Yonkers, New York, for their catalogue of standard tests. At the present time it is entirely possible in such subjects as reading and arithmetic for a teacher to discover the particular difficulties of individual pupils. It is highly desirable that she do this Often she can make out her own tests for purposes of diagnosis. Diagnostic tests are most valuable when used as individual tests Good diagnostic tests are so detailed and minute in their analysis and there are so many items that the results are revealing as to the exact achievement of the pupil A pupil may be able to multiply 21 by 2 but he would fail on 201 times 2, and the reason is obvious A child might be able to add $\frac{3}{4}$ and $\frac{2}{3}$ but he could not add $2\frac{3}{4}$ and $1\frac{2}{3}$ because he has not as yet learned the necessary steps. A child might be able to add 2 and 1 but he could not add 2 and 0. He has not yet learned that particular item of skill and knowledge It is more difficult to make satisfactory tests in reading than in arithmetic because reading skills are more numerous and more difficult to learn and to measure. Send to the Bureau of Publications of Teachers College, Columbia University, for lists and prices Ask about the *Gates Silent Reading Tests* and the *Gates Primary Reading Tests* Write also to the Public School Publishing Company, Bloomington, Illinois, and to Houghton Mifflin Company, Chicago From the standpoint of learning, diagnostic tests are the most useful of all tests Of course any diagnostic testing which is not followed by the appropriate remedial teaching is useless. During the past decade and more a great deal of testing has been a waste of time, energy, and money, because it has not been accompanied by suitable and necessary teaching and learning exercises or activities Diagnostic testing and remedial teaching should be as closely associated as the inside and the outside of a saucer, for they are merely two phases of a complete teaching-learning cycle

**Preparation of examination questions.** Teachers have sometimes prepared questions on the spur of the moment when the examination hour arrived. This is of course hazardous and does

not do justice either to the teacher herself or to her pupils. Examination questions should cover a specified portion of subject matter and not too large an area The teacher should think of the outstanding, pivotal concepts which have been stressed in class periods Pupils should be told in advance, at least the preceding day, how much and exactly what ground the examination is to cover Then she should consider the time available and make out her questions with that amount of time in mind In the average rural school, even for the very oldest pupils, any examination should usually not extend beyond an hour, a half-hour would no doubt be much better In preparing the questions the teacher should always consider what the proper or correct answers should be Often there are several equally good and acceptable answers It might be well for the beginning teacher to write out the answer to each question and to time herself on each answer and on all of the examination Usually in essay examinations the pupils should be given some choice of, say, three out of five or five or six out of eight or ten questions The teacher should weight the questions and the corresponding answers If possible, have each question usually of about the same weight and value so as to mark more fairly Mark each answer on a scale of ten Add the marks for each separate question, annex a zero to the total, and divide by the number of questions to determine the mark for the paper as a whole. Don't hurry pupils; but teach them to work expeditiously. Teachers should conduct many study and learning exercises on how most effectively to prepare examination papers. If possible, hectograph the questions Make examinations relatively short and more frequent, if necessary So far as possible, dispel all nervous strain or excitement Eliminate all temptations to dishonesty Take great pains to make out high-grade examination questions. Keep a large stock of them on hand. Homemade questions are usually the best ones to use

**Methods of conducting tests.** Rural teachers should not think of examinations as formal, selective procedures to be conducted with more or less of ceremony or solemnity That is

entirely the wrong attitude In a rural school the chief and almost the entire function of tests and examinations is educative rather than selective Pupils should learn to look upon all tests as merely a part of the general teaching-learning activity of the school Days or half days should never be set aside for examinations A class period of thirty to forty minutes should be the longest time for an examination or test, as a rule Most of the objective tests will take only a few minutes, for the essay examination, often a single question which can be answered in five, ten, or fifteen minutes is best. A single paragraph today and another tomorrow, and so on, will give the teacher ample evidence upon which to do her grading It is no doubt usually best to have test and examination questions very clearly and neatly hectographed so that each pupil may have a copy Teachers should insist upon all tests being done carefully and neatly Good paper and pencils should be used, pupils or the teacher should file the test papers Tests should be conducted in good form and never hurriedly In making use of all formal standardized tests, teachers will always find complete directions in the accompanying manual for conducting the tests, scoring the papers, and computing various individual grades which may be desired The publishers have done a very creditable piece of work in preparing most of these tests; teachers should carefully read and follow the directions Teachers should bear in mind that the *manner* of conducting examinations and tests may many times be of greater moment than the content of subject matter.

**How to mark test papers.** Of course the scoring of modern educational tests, whether standardized and formal or the new, nonstandardized, objective tests, is a procedure which is quite definite and certain and not governed by the subjective judgment of the teacher It is also true that the grading of intelligence test papers is an exact business to be carried out according to very precise directions Marking papers comes to be a more difficult problem only when the essay type of examination is used Here are some specific suggestions concerning this part of a teacher's work

1. Many answers are either entirely right or altogether wrong If right, the mark is *10*, on a scale of ten, using a percentage system If wrong the mark is of course *0* A word is spelled either correctly or incorrectly In the fundamental operations in arithmetic, the computation is perfect or it is not The pupil either names the right capital of Russia or he does not

2 Some answers are partly right and partly wrong If a pupil is asked to discuss a topic in history or civics his answer may be worth 10 per cent if he covers the essential points If he omits important items, he may get nine, eight, seven, or less In solving a problem in arithmetic, the process may be correct, but with an error in computation There should be an understanding as to how much credit shall be given in such cases. Or the answer may be correct and the reasoning may have some fallacy in it Such an answer may be worth nothing or perhaps something, depending on the circumstances in the given case

3 Young teachers are apt to mark too high because they lack standards, or knowledge, or judgment, or all three Older teachers may give marks which are too low because of the breadth and accuracy of their knowledge, because of too critical a habit of mind, or because of a combination of personal qualities which may lead them to make a too minute and detailed analysis of pupils' answers. Such teachers habitually hew to the line and make no allowances

4 If a pupil answers correctly in a given subject, so far as that particular subject matter is concerned do not penalize him because of misspelled words or incorrect English, unless, indeed, there may be some definite understanding in advance. John may spell all of his words correctly although his writing may be obviously and painfully bad Mark him on writing at some other time or at least separate the spelling and the writing marks on the same paper Mary may solve all of her problems and thus be entitled to 100 per cent She may have made several errors in grammar and punctuation. Nevertheless, in *arithmetic* she has earned 100 per cent However, some teachers give credit for neatness and form, which is proper if everyone knows before-

hand about the arrangement Pupils are entitled to credit for what they have learned, know, and can do Be careful not to mix credits for a certain achievement with penalties for some lack or deficiency

5 There is a tendency today to use letters instead of per cent grades Be sure that all—parents, pupils, and teacher—know exactly what each letter means and that all interpret them alike. It may be quite all right to mark *E*, excellent; *G*, good, *F*, fair, and *P*, poor, with an *F* in red for total failure In many school systems today the letters *A*, *B*, *C*, *D*, *E*, and *F* are used, often with the associated *A*− or *A*+ and *B*− or *B*+, and so on *E* means a condition and *F* means complete failure. No elaborate system of any sort is needed in a country school The essential matter is to see that each child has a square deal, that all are marked according to the same plan, and that each child is given a definite grade in accordance with his actual achievement A teacher must know whether the written achievement of a child is excellent, or very good, or only good, or fair, or poor Excellent may mean from 90 to 100 per cent, poor may mean 70 per cent or below that. It is very easy for marks of any kind to become a real hindrance instead of promoting the true ends of education.

6 In old-type examinations, questions vary greatly in difficulty Some teachers habitually make out relatively easy questions and some are inclined to go to the other extreme Teachers and schools differ to a marked degree in their examination standards, that is what makes the old-type test such an uncertain quantity The only safe course so far as the individual pupil is concerned is to consider *all possible factors* which may affect the decision in classifying the child, in promoting him, or in not promoting him.

7 No teacher should delude herself into thinking that she can usually grade pupils as closely as a fraction of 1 per cent on the essay type of examination We have heard of many cases, to illustrate, where the position and honor of valedictorian of a class has been determined by fractional per cents One salutatorian received an average of $88\frac{1}{4}$ per cent for the four years in

high school; the valedictorian was chosen because he had a mark of $88\frac{3}{8}$ per cent! Such absurd and even tragical practices are enough to excite our ire, when we speculate upon an overworked and unjust examination and marking system

8 In marking any pupil's paper do not permit extraneous influences, personal or otherwise, to determine the grade Every child is entitled to what his paper is worth, whatever his social status, his conduct, or his previous school history He has answered the questions, the teacher should honestly and impartially mark the paper to the best of her ability If it were possible to mark every paper without knowing which pupil wrote it, the resulting grades would often be nearer the actual facts and the individual would receive fairer treatment

9 Be cautious about making use of the normal distribution curve in determining the relative marks of a given group of pupils. At least be slow to distribute grades in accordance with the normal curve In a rural school the classes are usually very small, the teacher knows each pupil so well that she is able to adapt her procedures more exactly and more justly to individual differences and needs In a large mixed group of high-school freshmen, let us say 200, taking an ordinary eighth-grade spelling test of 100 words, the normal curve would probably apply with considerable accuracy Perhaps about 10 per cent would receive a mark of 95 or better, about an equal number would get 80 or much lower, around 20 per cent might earn a mark between 90 and 95, another 20 per cent would have grades from 80 to 85; very likely approximately 40 per cent or two-fifths of the group (in this case about 80 students) would be graded somewhere from 85 to 90, or from a few points lower to a few points higher. But, by having a select class of very good spellers, the normal curve would not apply Or by using exceptionally difficult words with an average group of students, the curve would be decidedly *skewed* It should be noted that in such subjects as spelling the marking of papers is an exact procedure In history and similar subjects, grading the essay type of examination is much more difficult, although the normal curve would also be applicable.

By using hard questions which are too difficult for the particular class, all the pupils in a class may fail; by using very easy questions all may succeed Every teacher must adapt her teaching, including examinations, to the needs of her own particular group If over half of a class fail, no doubt something is wrong with the examination, the pupils have not had a chance to prepare, or the teacher has not done enough teaching. If everyone gets a high mark, too high a mark, again something may not be properly adjusted A teacher learns to make adjustments only through experience.

10 In a rural school the general problem of examinations and tests and this special problem of marking papers should be relatively easy, because the teacher can know the conditions so well Do not let marks disturb you too much, interfere with teaching and learning, or come between you and any child Do not bank too much on any single test In marking papers, always consider the effect of success and failure upon the individual pupil If marks are used judiciously, they can be made to motivate the work of the school to a considerable extent. Remember that it will not do at all for any pupil to receive failing marks time after time Every effort must be made to have the pupil with low grades get better ones if at all possible Undoubtedly all examinations and tests must be adapted to particular groups, at least to a considerable extent There are no absolute standards applicable to all schools except such standards as those of honesty, and the duty of everyone to do his best. Mark papers so as to help pupils, not to weaken them Rural teachers and all other teachers should make use of all examination and testing procedures to further the objectives of education and of teaching and learning. All artificiality and all unjust treatment of any pupil should be eliminated

**Testing for classification and promotion.** In rural schools, if indeed in any schools, there should be no rigid system of classification or promotion. Pupils should uniformly and regularly be placed in classes where they can do the best work, they should be promoted whenever their achievement and progress

will warrant it. A child may be able to read well enough to be in the fifth- and sixth-grade class in reading, but his ability in arithmetic may be such that he properly belongs in the next lower class. There are many other factors which should be considered in classifying and promoting pupils beside the grades obtained by any testing. Chronological and mental ages, size, health, nervous stability and energy, family conditions, daily work, personality qualities as shown by industry and application, intelligence quotient, educational quotient, accomplishment ratio, teacher's judgment, ability to read with comprehension and speed—all of these and other factors should be carefully considered The whole effect upon the child, his success or failure, his happiness or depression, his probable chances to go on, all these are important elements of the situation The *Otis Classification Test*, published by the World Book Company, is a combined mental and achievement test for use in grades 4 to 9, inclusive The achievement test comprises questions in reading, spelling, language and grammar, arithmetic, geography, history and civics, hygiene, vocabulary, music, and art. The test is self-administering; the time for each of the two parts is thirty minutes. The teacher will find norms included in the manual which accompanies the test. There are three forms, *A*, *B*, and *C*, each of the same character but with different items. The reliability coefficient of this test is high. Any teacher can get a specimen set for twenty cents. Rural teachers will do well to have on hand a good number and variety of tests which can be used as occasion demands. Rural teachers need such helps more than any other class of teachers

**Summary of suggestions and cautions in the preparation and use of tests** The preceding discussion may be briefly summarized as follows.

1. Use tests chiefly as an essential part of the teaching and learning processes. They should react beneficially upon learning activities.

2 Cultivate a wholesome and proper attitude toward testing, so that the child will regard all testing exercises as an essential part of the school procedure.

3. Always give pupils abundant opportunity to prepare for tests Pupils should both *do* their best and *want* to do their best

4. Teach the older pupils to keep neat and correct records and graphs of their own test-achievement grades.

5 Tests should be clear, definite, specific, exact, and fair—never hurried or perfunctory

6 Bear in mind that not all learnings are measurable by any tests yet devised. Perhaps some of them never can be measured

7 Test questions should be such as will afford some measure of a pupil's ability to think, to do, to respond with certain skills, and to appreciate

8. Older pupils in the rural schools should be instructed in the methods of marking and scoring

9 The teacher should look upon tests as one of the best of agencies for gauging her own efficiency and indicating where she may improve

10 A specific or particularized assignment contributes to the good results of a test

11 Make profitable use of the tests which the publishers of textbooks furnish.

12 Make a collection of the best commercialized and standardized tests including mental tests, educational tests, and character tests, if satisfactory character tests are available

13 Do not use the results of any one test as a final record mark, or as a grade to place upon the report to parents

14. Pupils in rural schools should never be excused from tests and examinations When they are excused, tests and examinations appear to the pupils to have no important educational function

15. Mark all papers very promptly and let each child know his grade.

16 Use test and examination papers as a basis for class discussions

17 Make good use of objective pretests to obtain information as to how much pupils know about, or can do with, a new unit of subject matter, that is, get an inventory of your class

18. Use handwriting and spelling scales at any rate

19. The time to make use of a good mastery test is when a particular portion of subject matter has been studied under the careful direction and supervision of the teacher

20 The results of a test should be analyzed, both as regards individuals, and as regards the class as a whole.

21. Do not permit pupils to form the habit of complaining about their grades, but be careful to give no cause for complaint or criticism of the teacher's judgment.

22. Old test questions will often be useful for review purposes and should, therefore, be saved.

23. The learnings that may grow out of testing procedures may be more important than the actual test results and grades.

24 Use a good quality of such materials as paper, pencils, pen, and ink, especially for tests that are to be filed for the year

25 Pupils should not be obliged to write tests and examinations in the midst of various distractions

## REVIEW, TEST, AND PROBLEM EXERCISES

1 Outline a complete testing program for an average rural school to guide the teacher in her teaching-learning activities for one school year

2. Make a very careful and complete bibliography of tests and measures which you believe useful for a rural teacher For each enumeration name the author, the title, the publisher, and the date of copyright, in that order.

3 Make out twenty-five examination questions of the essay type to cover the ground of this chapter Arrange to have the questions of approximately equal value or weight

4 Prepare a hundred true-false and a hundred one-word completion tests on this chapter Write out the correct responses

5 Construct an inventory pretest on American history in general to discover how much a ninth-year high-school class knows about the subject Make your test objective and provide for at least one hundred items Be sure that you know the answers

6 Write a set of twenty good, practicable questions of the open-book type to be used when a class has completed a study of the geography of South America

7 Carefully enumerate all of the difficulties and problems you can think of in the field of marks and marking, and then tell specifically how you believe these problems can be solved Take into account various subjects and types of questions, as well as marks in relation to classification, promotion, and reports to parents. Use references. Consider the average rural school situation in working on this exercise.

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# APPENDIX

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pendium of useful information on a wide range of subjects. Send for The Lincoln Library Aid. No cost.)

## TEACHING-LEARNING UNIT MATERIALS

1. *Compton's Pictured Teaching-Unit Materials* F E Compton and Company, 1000 North Dearborn Street, Chicago. 1935 Price $2.40 up, depending on quantity purchased An excellent collection of source material for teacher and pupils, giving background information together with sets of pictures in color (with detailed study information on each) on 18 of the most generally taught social-science subjects Send without cost for *An Introduction to the New Compton's Pictured Materials for the Improvement of Classroom Instruction.*
2. *Unit Teaching Materials*, including *Childcraft*, six volumes with Art Book and Guide. Volume six, *Activity Units*. (Sixteen units are outlined in detail) W F. Quarrie and Company, 35 East Wacker Drive, Chicago 1935 (Write company for prices and for information on a new series of teaching-learning units now in preparation. See introduction to volume six of *Childcraft* on "The Use of Activity in Learning," by H R. Vanderslice)
3. *Foundation Classroom Materials* Eight volumes or 16 volumes of *Book Trails* and 40 teaching-learning units. Teachers may purchase from ten to forty units, as desired Child Development Foundation, Inc, 180 North Michigan Avenue, Chicago. 1936. Prices range from $14.75 to $59 50, depending on quantity of material and service purchased Individual units, 70 cents each.
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SUGGESTED DAILY PROGRAM (MODIFIED BLOCK PROGRAM) FOR ONE-TEACHER SCHOOLS—(*Continued*)

DEPARTMENT OF PUBLIC INSTRUCTION, COMMONWEALTH OF PENNSYLVANIA, HARRISBURG

| Time | Min | Grade | Class Schedule | Self-Directed Study and Other Activities | | |
|---|---|---|---|---|---|---|
| | | | | Group C Grades 1, 2–3 | Group B Grades 4–6 | Group A Grades 7–8 |
| 12 00<br>12 20 | 20<br>40 | All<br>All | Lunch period<br>Play period | Hands washed Lunch eaten at desk or table except when weather is mild and pupils wish to eat on playground Refuse from lunch given proper care | | |
| 1 00 | 15 | 1–3 | English [8] 4 days Health Instruction [9] 1 day | Class Period | English 4 days Health Instruction 1 day | English 4 days Health Instruction 1 day |
| 1 15 | 15 | 4–6 | English [8] 4 days Health Instruction [9] 1 day | Activities growing out of classwork in English or Health Instruction | Class Period | |
| 1 30 | 20 | 7–8 | English [8] 4 days Health Instruction [9] 1 day | | Spelling and Word Study | Class Period |
| 1.50 | 5 | 1–6 | Teacher checks work where needed | | | Spelling |
| 1 55 | 20 | All | Spelling 3 days<br>Handwriting 2 days | Spelling and Handwriting exercises adapted to ability of each group | | |
| 2 15 | 15 | All | Recess | Teacher directs activities but develops pupil leadership and responsibility | | |

SUGGESTED DAILY PROGRAM (MODIFIED BLOCK PROGRAM) FOR ONE-TEACHER SCHOOLS—(*Continued*)

DEPARTMENT OF PUBLIC INSTRUCTION, COMMONWEALTH OF PENNSYLVANIA, HARRISBURG

| Time | Min | Grade | Class Schedule | Self-Directed Study and Other Activities | | |
|---|---|---|---|---|---|---|
| | | | | Group C Grades 1, 2–3 | Group B Grades 4–6 | Group A Grades 7–8 |
| 2 30 | 20 | 4–8 | Reading [3] Group A 2 days Group B 3 days | Activities related to reading | Self-test in thought-reading 2 days Class period in reading 3 days | Self-test in thought-reading 3 days Class period in reading 2 days |
| 2 50 | 25 | 1–3 | Reading [10] | Class Period | Reading of reference materials related to History or other subjects | Library and Supplementary Reading [12] Activities |
| 3 15 | 20 | 4–6 | History-Civics 3 days Health Instruction [9] 1 day Art [11] for all grades 1 day | Initiation or continuation of activities requiring additional time 4 days Art 1 day | Class period 4 days Art 1 day | History-Civics 3 days Health Instruction 1 day Art 1 day |
| 3 35 | 5 | 1–3 | Teacher checks and directs activities of Group C | | Activities growing out of History-Civics or Health Instruction 4 days, 15 minutes Last 10 minutes for free period 2 days and remedial work 2 days Art 1 day | |
| 3 40 | 20 | 7–8 | History-Civics 3 days Health Instruction [9] 1 day Art [11] for all grades 1 day | Self-tests in thought-reading 4 days Art 1 day | | Class period 4 days Art 1 day |

## SUGGESTED DAILY PROGRAM (BLOCK PROGRAM) FOR ONE-TEACHER SCHOOLS

Department of Public Instruction, Commonwealth of Pennsylvania, Harrisburg

| Time | Min | Block Schedule | Activities: Group C Grades 1 2-3 | Activities: Group B Grades 4-6 | Activities: Group A Grades 7-8 |
|---|---|---|---|---|---|
| | - | Informal Morning Survey [1] (as pupils arrive) | | | |
| 9 00 | 15 | Block I<br>Morning Assembly [2] and Music | | | |
| 9 15 | 60 | Block II<br>Arithmetic | Integrated or unit activities in reading, arithmetic and handwork | Arithmetic | |
| 10 15 | 15 | Recess | Directed play or concrete activities—outdoors when weather permits | | |
| 10 30 | 30 | Block III<br>Reading [3] | Teacher works with one grade while remainder of group studies reading | Reading newspapers or periodicals<br><br>Spelling and Vocabulary Activities including use of dictionary | |
| 11 00 | 60 | Block IV<br>Geography-Science [4]<br>Music [5] and<br>Club Activities [7] | Activities related to social studies [6] including science, geography, history and civics adapted to ability of each grade<br>If advisable the younger pupils may have longer noon period | Geography 3 days<br>Science 1 day<br>Music and<br>Club Activities 1 day | |

## SUGGESTED DAILY PROGRAM (BLOCK PROGRAM) FOR ONE-TEACHER SCHOOLS—(*Continued*) *

DEPARTMENT OF PUBLIC INSTRUCTION, COMMONWEALTH OF PENNSYLVANIA, HARRISBURG

| TIME | MIN | BLOCK SCHEDULE | ACTIVITIES | | |
|---|---|---|---|---|---|
| | | | Group C Grades 1, 2-3 | Group B Grades 4-6 | Group A Grades 7-8 |
| 12 00<br>12 20 | 20<br>40 | Lunch period<br>Play period | Hands washed Lunch eaten at desk or table except when weather is mild and pupils wish to eat on playground Refuse from lunch given proper care | | |
| 1.00 | 75 | Block V<br>English [8] Tools<br>English Expression<br>or Health [9]<br>Spelling<br>Handwriting | English 4 days<br>Health Instruction 1 day | | |
| | | | Spelling and Handwriting exercises adapted to ability of each group | | |
| 2.15 | 15 | Recess | Older pupils take responsibility for directing some play periods | | |
| 2 30 | 45 | Block VI<br>Reading [3] | Individual remedial reading activities [10] | Library Activities [12]<br>The group working independently is given an assignment in self-testing thought-reading | |
| 3.15 | 45 | Block VII<br>History-Civics<br>Health [9]<br>Art [11] | Continuation of unit in social studies including Art and Health | History-Civics 3 days<br>Health Instruction 1 day<br>Art 1 day | |

* The above programs used by permission of the Department of Public Instruction of Pennsylvania

## SUGGESTED DAILY PROGRAM (MODIFIED BLOCK PROGRAM) FOR ONE-TEACHER SCHOOLS

DEPARTMENT OF PUBLIC INSTRUCTION, COMMONWEALTH OF PENNSYLVANIA, HARRISBURG

(Small superior figures, 1 to 12, refer to the explanatory notes)

| Time | Min | Grade | Class Schedule | Self-Directed Study and Other Activities | | |
|---|---|---|---|---|---|---|
| | | | | Group C Grades 1, 2–3 | Group B Grades 4–6 | Group A Grades 7–8 |
| | | All | Informal Morning Survey [1] (as pupils arrive) | | | |
| 9 00 | 15 | All | Morning Assembly [2] and Music<br>Music 30 minutes a week<br>Other Activities 45 min a week | | | |
| 9 15 | 20 | 4–6 | Arithmetic | Activities related to reading | Class Period | Arithmetic |
| 9 35 | 5 | 1–3 | Teacher checks work of Group C | | Arithmetic | |
| 9·40 | 15 | 1–3 | Arithmetic | Class Period | | |
| 9 55 | 20 | 7–8 | Arithmetic | Arithmetic | | Class Period |
| 10 15 | 15 | All | Recess | Directed play or concrete activities—outdoors when weather permits | | |

SUGGESTED DAILY PROGRAM (MODIFIED BLOCK PROGRAM) FOR ONE-TEACHER SCHOOLS—(*Continued*)

DEPARTMENT OF PUBLIC INSTRUCTION, COMMONWEALTH OF PENNSYLVANIA, HARRISBURG

| Time | Min | Grade | Class Schedule | Self-Directed Study and Other Activities | | |
|---|---|---|---|---|---|---|
| | | | | Group C Grades 1, 2–3 | Group B Grades 4–6 | Group A Grades 7–8 |
| 10 30 | 30 | 1–3 | Reading [3] | Class Period | Library and Supplementary Reading [12] Activities 15 minutes<br>Vocabulary Activities including use of dictionary 15 minutes | Reading newspapers or periodicals 15 minutes<br>Spelling and Vocabulary Activities including use of dictionary 15 minutes |
| 11 00 | 20 | 4–6 | Geography 3 days<br>Science [4] 1 day<br>Music [5] for all grades 1 day | Library or Supplementary Reading [12] Activities 4 days<br>Music 1 day | Class Period | Geography 3 days<br>Science 1 day<br>Music 1 day |
| 11 20 | 15 | 1–3 | Social Studies [6] 4 days<br>Music [5] for all grades 1 day | Class Period | Geography 3 days, 25 minutes<br>Science 1 day, 25 minutes<br>Spelling 4 days, 15 minutes<br>Music and Club Activities 1 day | |
| 11 35 | 25 | 7–8 | Geography 3 days<br>Science [4] 1 day<br>Club Activities [7] for all grades 1 day | Activities growing out of class experiences in social studies 4 days<br>Club activities 1 day | | Class Period |

# EXPLANATORY NOTES TO THE PENNSYLVANIA PROGRAMS

1. The survey of the room includes temperature, light, tidiness, and attractiveness An informal survey of pupils as they arrive is usually preferable. This includes general appearance of pupils and indications of communicable disease. In case of an epidemic or a threatened epidemic, the survey should be especially careful and include thorough scrutiny for symptoms of the threatened disease.

2 This period should be a bright spot in the day's experiences The Bible selection to be read and song selections should be chosen with care Additional exercises should be stimulating and interesting to the whole group and to those taking part, such as consideration of important news items, reports of interesting observations related to science

3. The teacher will work with each grade in Group C separately and when advisable with individuals In Groups A and B, there will be greater possibilities for combining grades, although in these groups, also, there will be cases that need individual help

4 The materials and conditions found in the community should be considered by the teacher when determining units in science. The birds, trees, flowers, insects, and animals of the local region should be given first place The work in agriculture for the eighth grade is included in the science period

5. In addition to songs in morning assembly and at other appropriate times through the day, a period of thirty to thirty-five minutes for instruction in music is provided one day in the week The teacher may divide the time between the older and younger pupils when the older group is able to work on more advanced lessons, with assigned work in music for the group not actively engaged in singing or other musical activity.

6 Social studies include the study of how man learns to live successfully as an individual and as part of a group. The block program provides greater opportunities to use large units of learning that may include history, civics, geography, and science.

7 This period may be given over to any club activities that provide experiences which the teacher thinks are meeting essential needs of the pupils. An Our Times Club or other club dealing with current affairs, should include worth-while activities related to the community in which the pupils live as well as those reaching into national and world relationships

8. In this period, the teacher gives attention to developing abilities and skills in the use of written and oral expression and in spelling Activities in any subject expressed in writing, in addition to the subject matter involved, should be considered an exercise in expression, spelling, and handwriting Pupils should be encouraged to evaluate all their written productions on a basis of those points

9 Two periods a week are given to health instruction These periods may be on the same day if the unit lends itself to such an arrangement Certain units in health may be developed by the whole school, each group sharing in this development through the assignment of portions of the unit that are within the ability and appreciation of the group involved In short the principles underlying health care should permeate all the activities of school life This is especially true in relation to safety education Safe practices should be integrated with every activity of the program. A survey of safety hazards in rural communities should be made and reports given in English, health, civics, or other periods The relief, recess, and noon periods, also, provide opportunities for health and physical education activities Here the pupils should carry out the practices discussed in the health classes Behavior during the lunch hour illustrates to a considerable degree, the effectiveness of health instruction. The teacher should be aware of the value of relief periods and take time for them when needed A change of position through active mimetic exercises, simple games or songs, or a change in ventilation, frequently removes conditions unfavorable to work

10. This program is arranged for those schools where Group C remains until the end of the school day. Teachers should keep in mind the fact that unless every condition is safe, young children should remain in school until the older pupils are ready to accompany them In schools where primary pupils are excused early, the reading period of this group may be scheduled before those of Group A and Group B

11 The work of the art period includes the development of skills

and appreciations that are needed to carry out integrated experiences with a subject other than art as the starting point

12 Pupils should be taught to develop library materials by the addition of booklets relating to units considered in the various subjects of study, and of suitable selections secured from magazines and other printed materials.[1]

[1] The foregoing Pennsylvania programs, prepared by Miss Helena McCray, are reproduced by permission of the Department of Public Instruction, Commonwealth of Pennsylvania, Paul L. Cressman, Director of Instruction

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